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CONTENTS OF PREVIOUS NUMBER

JANUARY 1947. NUMBER 1

Effect of Obliteration of the Endolymphatic Sac and Duct in the Monkey. J. R. Lindsay, M.D., Chicago.

Improved Surgical Technic Based on Modifications of Jansen-Ritter (Lynch) and Caldwell-Luc Procedures for Chronic Sinusitis. William Lawrence Gatewood, M.D., New York.

Radiation Therapy for the Removal of Adenoid Tissue. Donald F. Proctor, M.D., Baltimore.

Fenestration for Otosclerosis: Report of One Hundred and Twenty-Three Cases. Robert L. Moorhead, M.D., Brooklyn.

The Cochleogram and Its Clinical Application: A Preliminary Report. Julius Lempert, M.D., New York, and Ernest Glen Wever, Ph.D., and Merle Lawrence, Ph.D., Princeton, N. J.

Tinnitus Aurium: Some Considerations Concerning Its Origin and Treatment. Miles Atkinson, M.D., F.R.C.S., New York.

Management of Septal Deformities in Rhinoplastic Correction. Lester W. Eisenstodt, M.D., Newark, N. J.

Superior Petrosal and Cavernous Sinus Thrombosis and Basal Petrositis Observed as Complication of Destructive Labyrinthitis with Facial Paralysis. Francis L. Weille, M.D., Boston.

Thyroglossal Cysts and Sinuses: Analysis of Forty-Three Cases. Louis Hubert, M.D., New York.

Myiasis of the Nose. Captain Nicholas P. Popov, Medical Corps, Army of the United States.

Aerodynamics in the Physiology of the Upper Respiratory Tract. N. Vern Peterson, M.D., Rye, N. Y.

Abstracts from Current Literature.

News and Comment.

Society Transactions:

American Laryngological Association.

Book Reviews.

Directory of Otolaryngologic Societies.

ARCHIVES OF OTOLARYNGOLOGY

VOLUME 45 FEBRUARY 1947 NUMBER 2

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CONGENITAL CYSTS OF THE TONGUE, THE FLOOR OF THE MOUTH, THE PHARYNX AND THE LARYNX

GORDON B. NEW, M.D.
ROCHESTER, MINN.

CONGENITAL cysts of the tongue, the floor of the mouth, the pharynx and the larynx are rare but are particularly interesting because of the difficulty of their diagnosis and the problem of their complete removal. The patient may complain of repeated flare-ups due to infection of some part of the tongue, the pharynx or the larynx. At the time of such flare-ups, the cyst may rupture and some fluid may be discharged into the mouth or throat, but at the time of the examination shortly after the discharge of the fluid, little or nothing can be found to account for the symptoms. One must consider an infected congenital cyst as a possible cause. At times one sees patients who have had such symptoms many years without a diagnosis having been made. Congenital cysts that are not infected may produce no symptoms other than those due to their increase in size.

The congenital cysts that must be considered are: ranula, dermoid cyst, cystic hygroma, aberrant thyroglossal cyst of the tongue or of the floor of the mouth, branchial cyst of the pharynx and laryngeal cyst.

RANULA

The term "ranula" has been used to designate any cyst of the anterior part of the floor of the mouth; it should be used only to designate the thin-walled, epithelium-lined cyst that grows slowly, is sometimes of a bluish tinge, and is soft and easily compressible (fig. 1). This cyst fluctuates but does not pit on pressure. It is generally thought to be due to an obstruction of a duct of the sublingual gland, but this does not seem plausible in all cases because of the bilateral nature of the cyst in some instances and because only a part of the gland may be affected. This cystic tumor may be present at birth or may appear shortly afterward. It is readily distinguished from the dermoid cyst, owing to the thinness of its wall.

Johnston [1] stated that the cephalic intestine contributes to the formation of the floor of the mouth and that the complicated histogenesis of

From the Section on Laryngology, Oral and Plastic Surgery, Mayo Clinic.

Read at the meeting of the Middle Section of the American Laryngological, Rhinological and Otological Society, in Minneapolis, Jan. 16, 1946.

1. Johnston, W. H.: Cysts of the Floor of the Mouth, Ann. Otol., Rhin. & Laryng. **51**:917-930 (Dec.) 1942.

the lining epithelium explains the fact that congenital aberrations of the epithelium may contain all types of cells, varying from squamous cells to stratified or ciliated cells and cells which are undergoing mucoid degeneration.

Thompson [2] expressed the opinion that ranulas are of branchiogenic origin, but the fact that the thyroglossal tract is lined with ciliated epithelium may account for some of them.

There is no urgency about removal of a ranula unless it is causing difficulty in breathing or eating by displacing the tongue. Complete removal of the cyst is the treatment of choice. As the wall of the cyst is thin, dissection must be carried out carefully in order to remove all of the lining. The larger cysts may be opened and the lining destroyed

Fig. 1.—(*a*) Ranula of the floor of the mouth; (*b*) photomicrograph of ranula (in another case) showing a fibrous wall and a single layer of flattened epithelium (× 44.5).

by superficial surgical diathermy. An operation consisting of excision of the dome of the cyst and suturing of the lining of the cyst to the mucosa has been advocated, but I feel that the first two methods are preferable.

CYSTIC HYGROMA

Cystic hygroma is a multilocular lymph cyst which usually occurs primarily in the neck but may involve the floor of the mouth (figs. 2 and 3). If the cyst occurs in an infant, the mother usually brings the child to a physician because its tongue has a tendency to protrude. The cyst usually is found in the floor of the mouth or in the submental or the

2. Thompson, J. E.: Surgery and Embryology, Surg., Gynec. & Obst. **31**:18-33 (July) 1920.

submaxillary region. It is a multilocular lymph cyst. It has thin walls and an endothelial lining; it usually is filled with clear lymph. It is a retention cyst and is due to obstruction or lack of development of affer-

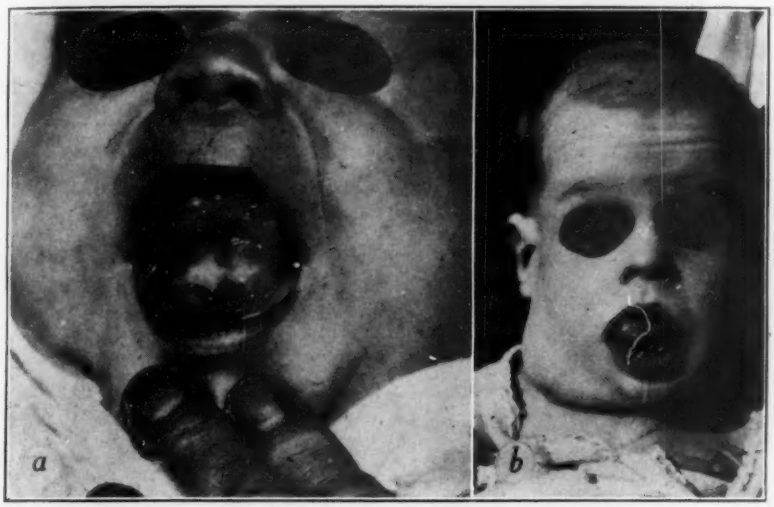

Fig. 2.—(*a*) Cystic hygroma of the floor of the mouth; (*b*) cystic hygroma involving the floor of the mouth and the submental and submaxillary regions.

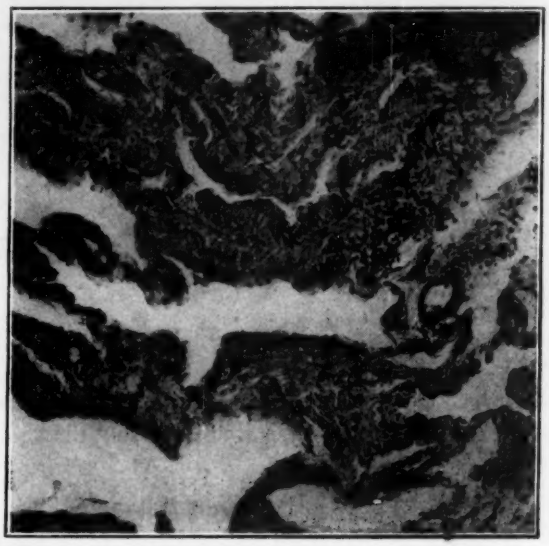

Fig. 3.—Cystic hygroma showing multiple lymph spaces.

ent lymph vessels. Examination discloses a smooth, thin cyst in the floor of the mouth, which causes bulging of the tongue. Palpation of the neck reveals an enlargement of one or both sides. Lymphangioma or

hemangioma of the floor of the mouth presents the same clinical picture except for the color of the angioma and the granular appearance of the lymphangioma. Microscopically, cystic hygroma and lymphangioma cannot be distinguished, and they react identically to radium treatment. Years ago, attempts were made to drain cystic hygroma by aspiration, but the cyst usually became infected and the patient died. Surgical removal is satisfactory if the patient can stand the operation. It is usually a long procedure if the lesion is bilateral. In case of a unilateral lesion, operation usually is satisfactory. At the Mayo Clinic, however, we have treated nearly all cysts of this sort with external radi-

Fig. 4.—(*a*) Dermoid cyst involving the floor of the mouth and the submental region; (*b*) photomicrograph of dermoid cyst (in another case) showing a lining of squamous epithelium and sebaceous glands in the wall of the cyst (× 93.5).

ation or radon seeds. Repeated treatment of this type causes the tumor to shrink so that there remains only a small residual thickening or some superfluous skin that may be excised.

Lierle [3] reported a case in which a lymphangioma of the tongue and the floor of the mouth was associated with a cystic hygroma of the neck. I have observed a similar case and believe that the two lesions are of the same nature.

3. Lierle, D. M.: Congenital Lymphangiomatous Macroglossia with Cystic Hygroma of the Neck, Ann. Otol., Rhin. & Laryng. **53**:574-575 (Sept.) 1944.

DERMOID CYST

A dermoid cyst which involves the floor of the mouth and the submental and submaxillary regions (fig. 4) may be situated either above or below the mylohyoid muscle or may extend from one region to the other through the muscle. A large cyst causes bulging of the floor of the mouth. The tongue may be back against the pharynx and may not

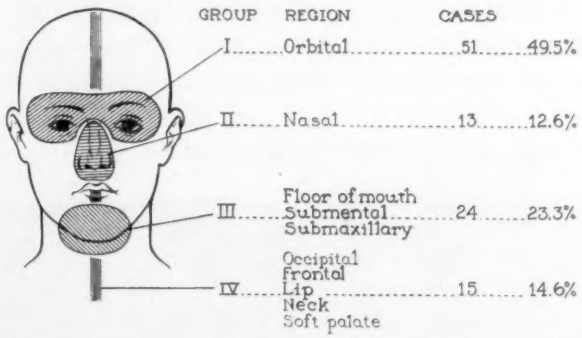

Fig. 5.—Sites of involvement in 103 cases of dermoid cyst of the head and the neck.

be visible; the submental region may be filled out like a large orange. The cyst usually tends to be spherical but may be elongated, particularly if it is situated above and below the mylohyoid muscle. It has a very thick wall, and if it is situated in the submental region or on the floor

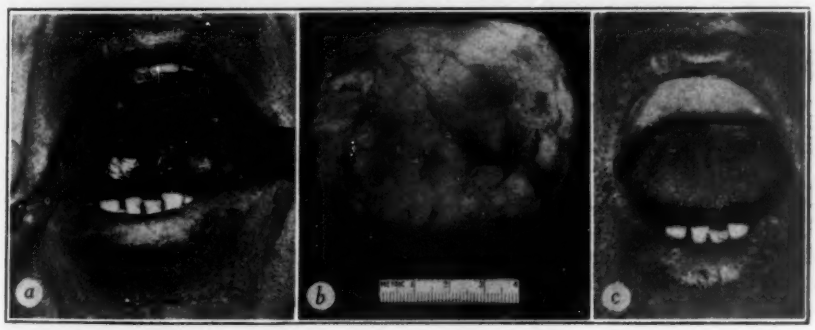

Fig. 6.—(*a*) Dermoid cyst of the floor of the mouth; (*b*) gross appearance of the excised cyst; (*c*) appearance of the mouth after removal of the cyst.

of the mouth, it feels doughy when examined bimanually. In the majority of cases the cyst occurs in the midline, but it may be situated laterally.

Dermoid cysts may occur in infants and interfere with breathing and deglutition. A child 1 month old had a huge dermoid cyst involving the floor of the mouth, the tongue and the submental and submaxillary

regions and displacing the tongue backward against the pharynx. It was removed through an incision of the floor of the mouth. A portion of the cyst projected through the mylohyoid muscle into the submaxillary region. The portion of the cyst above the mylohyoid muscle was about 4 cm. in diameter, and a projection about 2.5 cm. in diameter was present below the mylohyoid muscle. The tumor was so large that the palate and the pharynx were not visible until after the tumor was removed. It then was found that the child had a cleft palate.

Sometimes dermoid cysts rupture, intraorally or externally; they may become infected and cause repeated inflammatory swellings.

Of 1,495 dermoid cysts of the entire body reviewed by Erich and me,[4] 103, or 6 per cent, involved the head and the neck (fig. 5). Of the

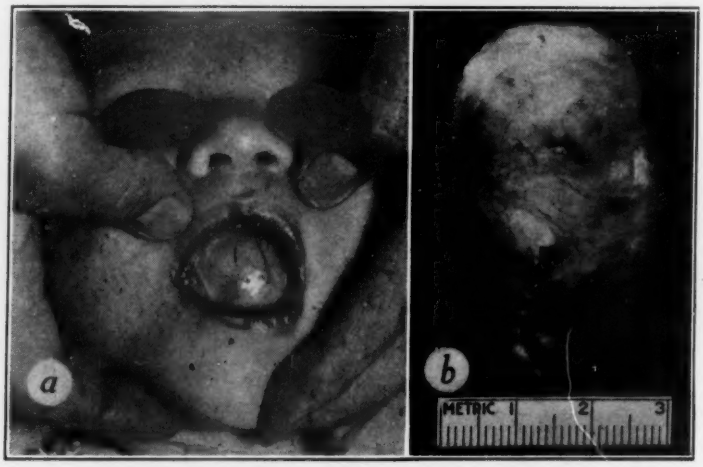

Fig. 7.—(*a*) Dermoid cyst involving the floor of the mouth and the submental and submaxillary regions of an infant 1 month old; the cyst fills almost the entire mouth, and the tongue is not visible; (*b*) gross appearance of the excised cyst; the smaller portion of the cyst was situated below the mylohyoid muscle.

dermoid cysts which involved the head and neck, 24, or 23 per cent, involved the floor of the mouth and the tongue and varied from 4 to 10 cm. in diameter.

I have observed 1 case in which it was necessary to open the trachea because infection of a dermoid cyst had displaced the tongue back against the pharynx.

Microscopically, the dermoid cyst has a thick fibrous capsule and a dermoid lining. A sinus may be present in the floor of the mouth or on the dorsum of the tongue, where the contents of the cyst may be discharged.

4. New, G. B., and Erich, J. B.: Dermoid Cysts of the Head and Neck, Surg., Gynec. & Obst. **65**:48-55 (July) 1937.

While in most cases a dermoid in this region is in the floor of the mouth (figs. 6, 7, 8 and 9), it may be present in the body of the tongue and a sinus may be present in the midline of the dorsum of the tongue, about halfway back. Infection of the tongue may occur frequently. This may cause considerable difficulty in swallowing and eating, and the cyst may rupture on the dorsum of the tongue. If radiopaque oil is injected into the sinus shortly after the cyst has ruptured, the outline of the cyst may be demonstrated (fig. 1).

In the differential diagnosis of the dermoid cyst, one must think of enlargement of the sublingual or the submaxillary glands and of a salivary calculus. Repeated infection of a salivary gland may simulate the infection of a dermoid cyst except that the infected salivary gland is

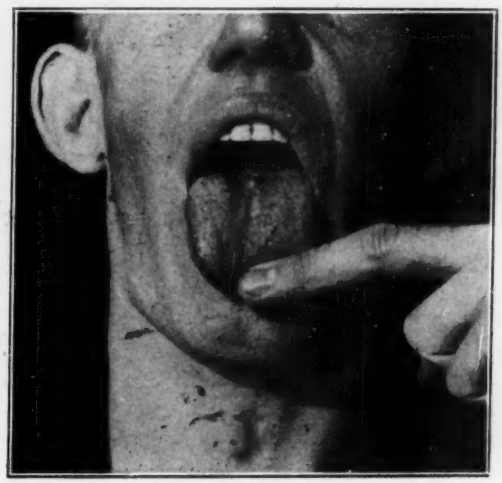

Fig. 8.—Dermoid cyst in the midline of the tongue.

situated laterally, while a dermoid cyst, as a rule, is situated in the midline. A roentgenogram of the submaxillary region or a roentgenogram of the floor of the mouth may reveal a calculus situated mesially to the angle of the jaw. Infection of a salivary gland or of a dermoid cyst may produce a sinus in the floor of the mouth or in the neck. An abscess of a molar tooth which has ruptured through the inner plate of the lower jaw and spread into the floor of the mouth must also be considered in the differential diagnosis. Complete removal of a dermoid cyst is advisable, and the approach should be made either externally or through the floor of the mouth, depending on where the largest part of the cyst is situated. If the cyst is to be removed through the floor of the mouth, an incision is made over the tumor and, after the wall is exposed and a line of cleavage is established, the cyst may be removed by blunt or finger dissection. Even a cyst which has extended submentally may be

pulled up through the muscle and removed through the mouth. A cyst that is situated in the submental region and has not extended far into the floor of the mouth or is badly infected is best removed externally through a submental incision.

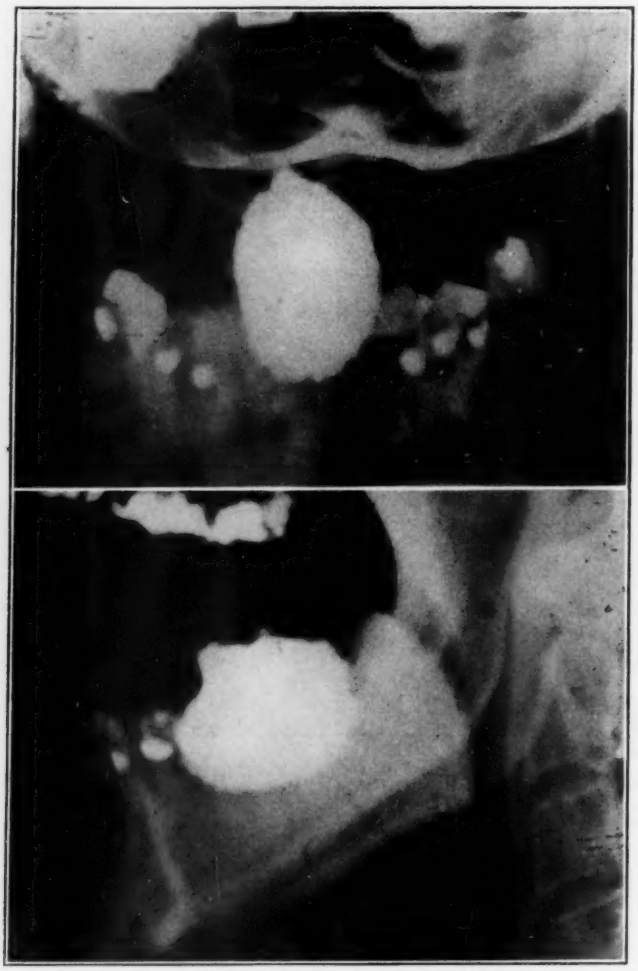

Fig. 9.—Anteroposterior and lateral roentgenograms made after injection of iodized oil in a case of dermoid cyst; a sinus is visible on the dorsum of the tongue.

THYROGLOSSAL CYST

The thyroglossal cyst is lined by stratified or ciliated epithelium (fig. 10). According to Arey,[5] the thyroglossal duct is present in the

5. Arey, L. B., cited by Duncan, G. W., and Daniel, R. A., Jr.: Cystic Tumor of the Tongue: Report of an Unusual Case, Arch. Surg. **44**:164-169 (Jan.) 1942.

embryo 4 weeks of age but normally atrophies during the sixth week of fetal life.

An aberrant thyroglossal cyst may cause repeated inflammatory swelling of the base of the tongue if it becomes infected. If a portion of the cyst remains below the hyoid bone, it produces swelling in the neck or a thyroglossal sinus externally in the midline. If there is incomplete obliteration of a thyroglossal duct and a portion remains in the region of the foramen cecum, repeated infection may cause a great deal of trouble. Such a condition is illustrated in the following case:

A man 43 years of age had attacks of swelling of the tongue and the throat for fifteen or twenty years. At first the attacks occurred once a year, but later they occurred several times a year. During the attacks, which usually lasted four

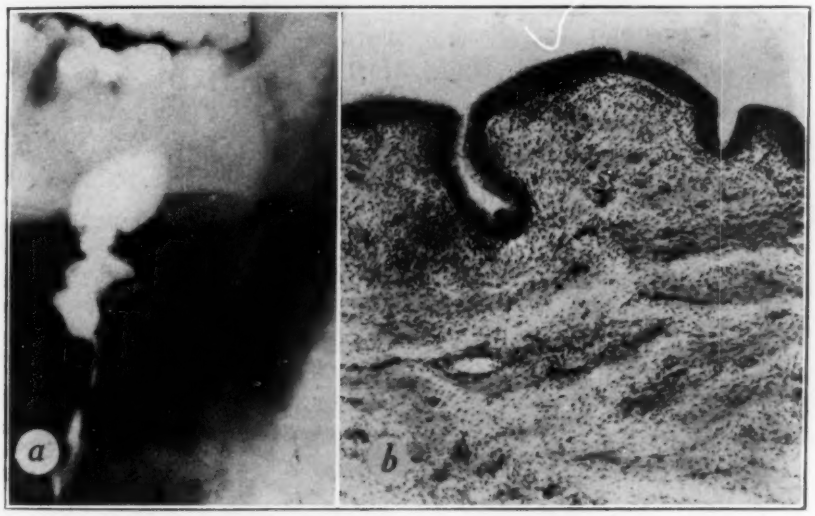

Fig. 10.—(*a*) Thyroglossal cyst; the cyst is situated below the hyoid bone and extends upward into the tongue; (*b*) photomicrograph of thyroglossal cyst (in another case) showing a lining of columnar epithelium and lack of lymphoid tissue (× 50).

or five days, his temperature increased to 101 or 103 F., and he had difficulty in swallowing and breathing. He had a great deal of trouble in swallowing fluids. Usually something apparently ruptured into his throat, and then the symptoms gradually improved. During all of these years, no diagnosis was made, and the patient was incapacitated on many occasions.

In a case of this kind, if the foramen cecum at the base of the tongue is examined with a laryngeal mirror shortly after the rupture of the thyroglossal cyst, an opening will be disclosed from which a small amount of mucopus is discharging. After the acute symptoms have subsided, iodized oil or some other radiopaque medium may be injected into the sinus with a curved syringe to outline the tract from the foramen

cecum down to, or anterior and below, the hyoid bone. A roentgenogram must be made immediately after the iodized oil has been injected (fig. 11).

The treatment of this lesion consists in removing the cyst or cystic tract in the interval between infections. A small cyst which is present on the dorsum or the posterior part of the tongue but does not extend down to the hyoid bone may be removed through an incision of the midline of the tongue. The walls of the cyst should be destroyed with surgical diathermy. The larger cysts and those which have been the site of repeated infection should be removed by the method of Sistrunk.[6] An incision is made in the skin of the neck below the hyoid bone, and the cystic tract is dissected upward to that part of the hyoid bone to which it is attached. The hyoid bone is divided on either side with bone forceps.

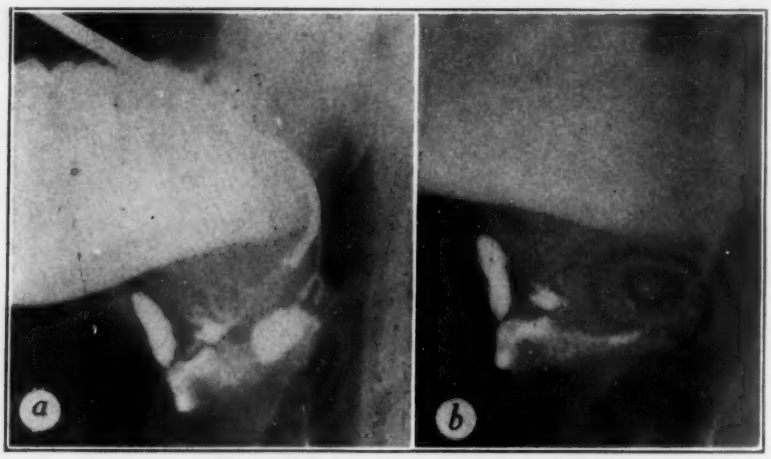

Fig. 11.—(*a*) Thyroglossal cyst that has ruptured into the foramen cecum (roentgenogram made after injection of iodized oil); the iodized oil has extended downward to the hyoid bone; (*b*) roentgenogram made a few minutes after the previous one; the iodized oil has extended downward below the hyoid bone.

An assistant presses on the foramen cecum at the base of the tongue while holding the tongue forward. A finger-like piece of muscle containing the thyroglossal duct is dissected out at an angle of about 45 degrees above and posterior to the hyoid bone. Better results are obtained by this method than by the old method of trying to demonstrate the epithelium-lined tract and dissecting it out without a core of muscle.

BRANCHIAL CYST

The branchial cyst (fig. 12) may be present laterally in the pharynx in the region of the posterior pillar, or below the tonsil, or in the hypo-

6. Sistrunk, W. E.: The Surgical Treatment of Cysts of the Thyroglossal Tract, Ann. Surg. **71**:121-122 (Feb.) 1920.

pharynx and at the base of the tongue. A branchial cyst extending into the pharynx is rare. A lateral extension of a congenital cyst of the larynx may be present in the hypopharynx at the base of the tongue.

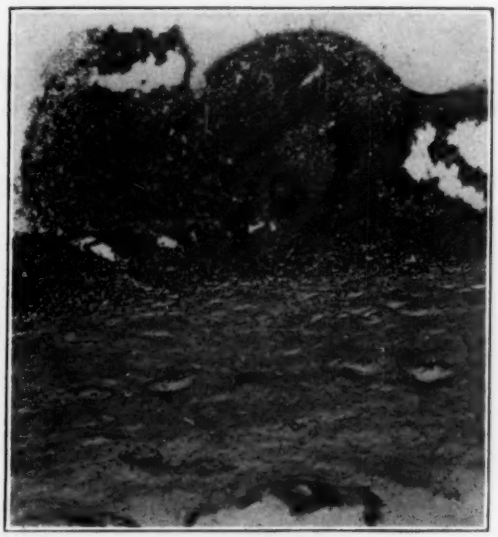

Fig. 12.—Branchial cyst lined with squamous epithelium; lymphoid tissue and lymph follicles are visible beneath the epithelium (× 50).

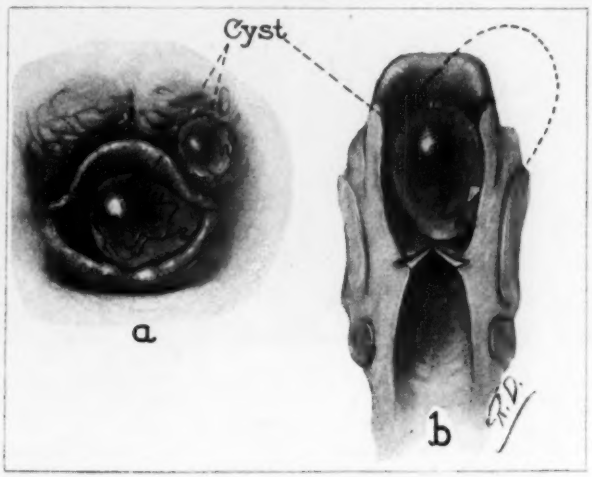

Fig. 13.—Drawing of a congenital cyst of the larynx: (*a*) extension into the vallecula; (*b*) lateral extension of the cyst, indicated by a dotted line.

The opening of the branchial cyst may be enlarged under suspension laryngoscopy and the cystic tract destroyed with surgical diathermy by the use of a protected point. A congenital cyst of the larynx or a bran-

chial cyst which extends laterally in the region of the vallecula may be removed under suspension laryngoscopy with surgical diathermy. I have never seen a cyst of this type that produced any serious symptoms but have removed this type of cyst by suspension laryngoscopy.

LARYNGEAL CYST

The congenital cyst of the larynx (figs. 13, 14 and 15) may not produce symptoms until adult life but may cause death once the larynx

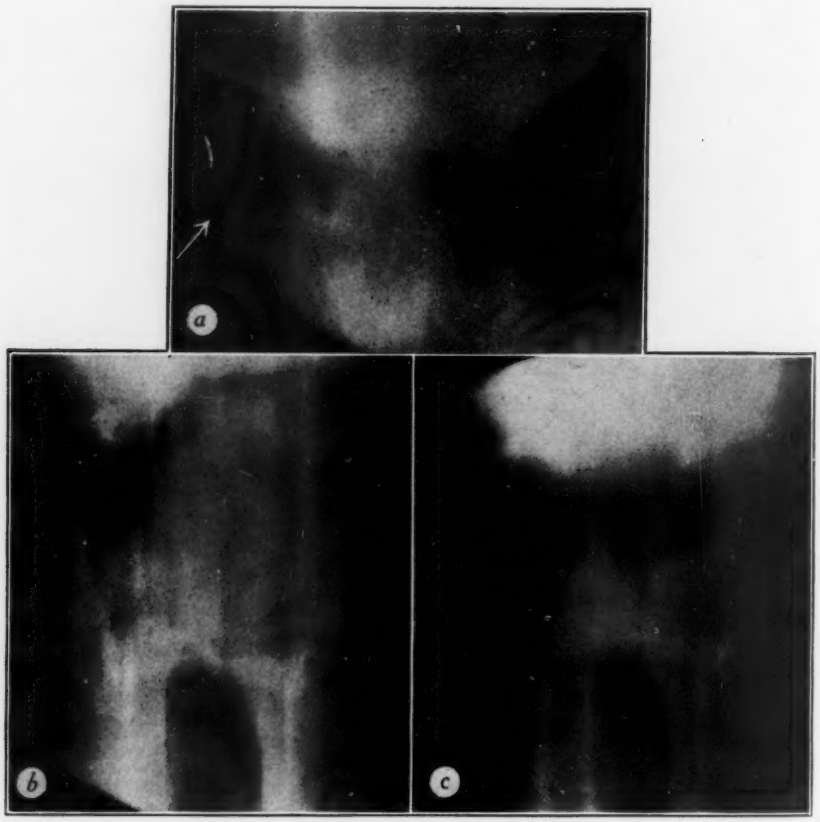

Fig. 14.—(*a*) Tomogram of a congenital cyst of the larynx; the intralaryngeal portion had been destroyed before the tomogram was made. (*b*) Tomogram of a huge congenital cyst of the larynx; no airway is visible. (*c*) Tomogram made after the cyst in *b* had been removed.

becomes obstructed by the mass present at the base of the epiglottis and the side of the larynx. Snaith [7] reported such a case. Although congeni-

7. Snaith, L.: Congenital Cyst of the Larynx Causing Fatal Asphyxia Neonatorum, Arch. Dis. Childhood **15**:274-276 (Dec.) 1940.

tal laryngeal cysts are rare, they should be recognized, since surgical removal produces excellent results.

There may be projections above the thyroid cartilage or in the hypopharynx. On two occasions, in doing a laryngectomy, I have cut across a congenital laryngeal cyst lateral to the thyroid cartilage, which had

Fig. 15.—Laryngeal cyst lined with stratified transitional epithelium (× 50).

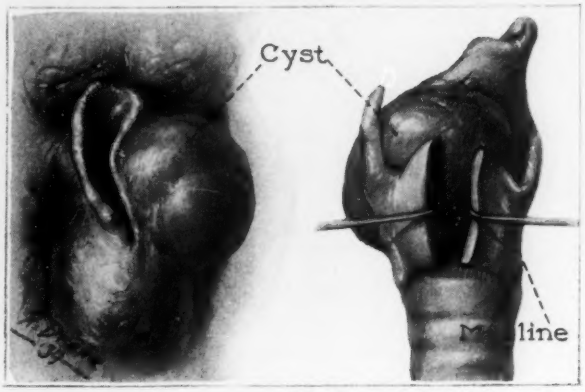

Fig. 16.—Lateral thyrotomy for removal of a congenital cyst of the larynx.

not caused symptoms of any kind. Recently, Erich and I [8] described the treatment of laryngeal cysts and recommended a lateral thyrotomy, to divide the thyroid cartilage, and dissection of the cyst with a cotton

8. New, G. B., and Erich, J. B.: Congenital Cysts of the Larynx: Report of a Case, Arch. Otolaryng. **30**:943-949 (Dec.) 1939.

applicator without exposing the larynx itself. This has proved to be a very satisfactory operation for complete removal of these cysts.

The following case was observed recently at this clinic:

A man aged 53 years had a hoarse voice for several years but did not have any other symptoms until six weeks before he came to the clinic, when he noticed a break in his voice and thought that he had laryngitis. At that time laryngeal examination disclosed a large tumor bulging the left side of the larynx. He had some dyspnea on exertion. When he was examined at the clinic he had a large cystic mass which involved the left side of the larynx and bulged into the piriform sinus. There was a very small airway, and the patient had mild dyspnea. The lesion appeared cystic. There also was some fulness above the thyroid cartilage externally. Tomography revealed a huge tumor, which arose above the thyroid cartilage and almost completely occluded the glottis. After a preliminary tracheotomy, a lateral thyrotomy was performed, and the cystic tumor (7.5 cm. by 5.5 cm.), which completely obstructed the glottis and filled the hypopharynx, was removed. The cyst was filled with a thick gluelike material. Dissection was performed with a cotton applicator. After removal of the cyst, the cavity was filled with sulfanilamide powder, and a Penrose drain was inserted. Microscopic examination revealed that the cyst was lined with stratified squamous and ciliated columnar epithelium. The patient made an uneventful recovery. Preoperative tomography disclosed the extent of the tumor, and postoperative tomography revealed that the larynx was normal when the patient was dismissed.

While congenital cyst of the larynx is rare, it should be completely removed by a lateral thyrotomy (fig. 16). Destruction of that part of the cyst which involves the inside of the larynx may entirely relieve the symptoms but may leave a cyst above and external to the thyroid cartilage, which may later cause symptoms.

THE JUNCTION OF THE NASAL CAVITY AND THE PHARYNGEAL TUBE IN THE RAT

GEORGE KELEMEN, M.D.
BOSTON

IN THE COURSE of examinations of serial sections of the nasal passages of the rat, some peculiarities were noted, of which no reports have been discovered. These peculiarities are (1) a communication between the right and the left half of the nasal cavity at the choanal end of the respiratory part and (2) certain conditions at and near the junction of the nasal cavity and the pharyngeal tube.

MATERIAL AND METHODS

1. The heads of 40 young rats were examined. The animals, of different strains and of both sexes, ranged in age up to 100 days. Their weight averaged 210 Gm., with limits of 82 to 295 Gm. After decapitation, the heads were preserved in a solution of formaldehyde, U.S.P., diluted 1 to 10, for periods up to four weeks. Nitric, trichloroacetic or formic acid was used for decalcification. After the specimens had been embedded in paraffin, the frontal sections were cut through the entire length of the nasal cavity by a noncontinuous method for an average of 40 sections per head. The sections were stained with hematoxylin-eosin. Some of the heads were handled according to the technic described by Morse.[1]

2. In the case of 1 rat continuous frontal sections were cut from the region containing the nasal cavity. In all, more than 500 sections were obtained.

3. The topographic correlations were proved by macroscopic dissections of the regions in question.

4. Through the courtesy of Prof. George B. Wislocki, the serial sections of the Minot embryologic collection in the department of anatomy of the Harvard Medical School were studied in order to clarify the developmental aspect of the region under investigation.

OBSERVATIONS

Communication Between the Right and the Left Half of the Respiratory Part of the Nasal Cavity.—Immediately behind the vomeronasal organ a cartilaginous intumescence forms a low arch above the nasal floor. It defines the lower edge of the septum nasi and the partition between the choanae. This edge, shaped like the upper half of a narrow ellipse (fig. 1 *B*) is the upper rim of an opening between the nasal airways of both sides. It is about 2 mm. high and 4 to 5 mm. long. At

From the Biological Laboratories, Harvard University.

1. Morse, A.: Formic Acid–Sodium Citrate Decalcification and Butyl Alcohol Dehydration of Teeth and Bones for Sectioning in Paraffin, J. Dent. Research 24:143-153 (June-Aug.) 1945.

the posterior end of the window the septal edge divides into two blades. These prolongations run in the direction of the lateral nasal walls and represent an oblique shelf, the terminal laminas; both sides together result in a V formation with its pointed end situated anteriorly. At the nasal floor a low ridge marks the lower circumference of the window. This V formation helps to explain the origin of the window. The two inferior nasal meatuses meet below the shelf of the terminal laminas to form an antechamber from which the anterior pharyngeal tube can be entered.

"Subseptal" Part of the Pharyngeal Duct.—The terminal laminas continue behind the V-shaped anterior edge so that the upper part of the septum remains a simple partition between the right and left halves of the ethmoid (olfactory) part of the nasal cavity, while its lower extremity is based on the roof of the pharyngeal tube. The terminal laminas are connected to the lateral nasal walls by two wings (fig. 1 *C* and *D*); under this shelf the anterior end of the pharyngeal duct is seen. In a cross section of this duct individual variations ranging from a more circular to the quadrangular or flattened form may be noted, corresponding to the range of difference in the individual nasal cavities (figs. 1 *D* and 2 *A*), i. e., from a high, narrow "gothic" type to a low, broad one.

The location of the anterior orifice is at the boundary of the anterior and the posterior half of the nasal cavity behind the posterior terminal part of the vomeronasal organ. The free posterior end of the septum nasi lies between this organ and the orifice of the duct. The anterior half of the nasal cavity (fig. 1 *A*) contains the nasoturbinal and the maxilloturbinal; the posterior part (fig. 1 *C* and *D*), the ethmoturbinals: three endoturbinals and two ectoturbinals. The high, short and narrow maxillary sinus (fig. 1 *B*) located above the posterior tip of the curved incisor and inward of the first molar is seen generally in the same sections where the bifurcating shelf of the terminal laminas reaches out to meet the lateral nasal walls.

Thus, the nasal end of the pharyngeal duct is situated under the posterior (ethmoid) part of the nasal passage. The floor of the duct is formed at this point by the solidly united palatal processes of the maxilla; the lower half of the lateral wall by the alveolar processes where the roots of the molars are separated at certain points by a paper-thin bony lamella from the lumen of the duct. Posteriorly, at the naso-pharyngeal border, the horizontal parts of the two palatines form the floor of the canal.

The frontal sections of the nasal cavity behind the choanae (fig. 2) show only the upper (olfactory) half which reaches with its blind-sac-like termination far behind the nasal orifice of the pharyngeal tube.

The two halves of the terminal lamina form a shelf, a second floor above the hard palate, which forms the first floor (figs. 1 *D* and 2 *A*).

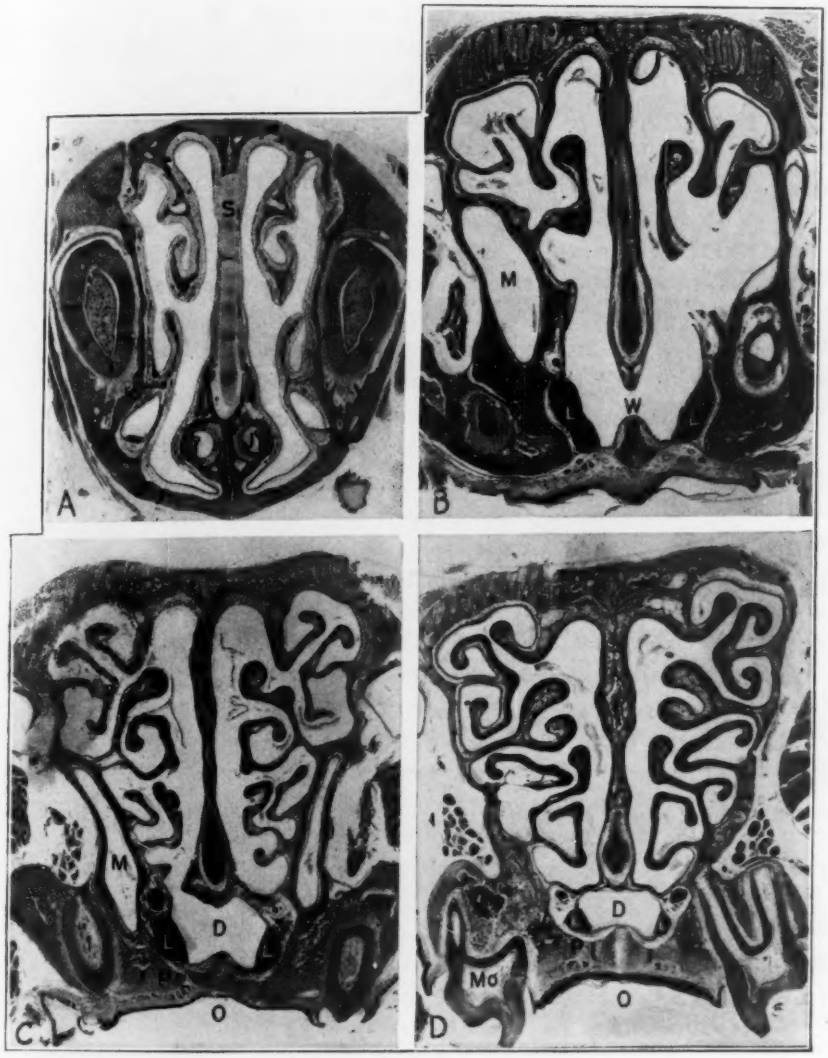

Fig. 1.—*A*, anterior part of the nasal cavity showing the septum (*S*) and the vomeronasal organ (*J*). *B*, choanal region. Note the window (*W*) in the lower part of the septum (*S*), the maxillary sinus (*M*) and the lymphoid masses facing the septal window (*L*). *C*, shelf extending from the septum to the lateral wall (the terminal lamina) on one side. *D*, subseptal duct (*D*), flat type

In this figure and in figures 2 and 3 the structures to be especially noted are designated by letters as follows:

C cul-de-sac
D subseptal portion of the pharyngeal duct
I incisor tooth
J vomeronasal organ
L lymphoid mass
M maxillary sinus
Mo molar tooth
N nasal capsule
O oral cavity
Ol olfactory tract
Or orbit
P palatal process of the maxilla
S nasal septum
W septal window

The anterior orifice of the duct is reached either from the right or from the left half of the nasal cavity by entering under the canopy formed by these horizontal shelflike or winglike partitions, which are very thin bony lamellas covered on both sides by respiratory epithelium.

The duct is lined with a high ciliated epithelium continuous with the nasal mucosa. It can be followed posteriorly at least to a point below the posterior extremity of the upper (ethmoid) half of the nasal cavity.

Massive lymphoid accumulations in the mucosa of the two opposite lateral nasal walls mark the region of the anterior orifice of the duct. Thick cushions of lymph follicles, showing the typical structure, inclusive reticulization of the epithelium and transmigration of lymphatic elements to the free mucosal surface, follow as a solid mass the foremost section of the canal, embedded in the lower half of the lateral wall.

Conditions in the Embryo.—The first definite sign of an opening of the choanae by formation of a window in the septum and building of a shelf between the septum and the lateral nasal wall was observed in an embryo of 16 days and 20 hours (fig. 3 *A*). The darker epithelial mass in the body of the ridge rising from the nasal floor appears to be the posterior end of the primordium of the vomeronasal organ. Above, the outlines of the nasal capsule are visible with early differentiation of the turbinates. The shelf below and laterally from the lower edge of the cartilaginous septum is present. Somewhat more posteriorly (fig. 3 *B*) the two passages are united. The choanal window at its point of opening and, in addition, the reduction in height of the ridge or raphe rising above the solidly united palatine processes of the maxilla are shown in figure 3 *C*, taken from an embryo of 18 days and 17 hours. This ridge (fig. 3 *D*) flattens down while the septum above broadens into its two processes directed against the lateral nasal walls: terminal laminas. Farther to the rear the concretion of the shelves and the lateral walls is complete (fig. 4 *A*). At the posterior end of the nasal passage (fig. 4 *B*) the outlines of the nasal capsule are seen with the posterior blind ending of the ethmoid part and the subseptal part of the pharyngeal duct as it continues in the direction of the nasopharynx.

COMMENT

Definite division within the nasal cavity exists in the marine chelonians, in which the organ is divided into two passages, one above the other and both connected by means of a perforation in the dividing shelf (Wiedersheim-Parker [2]).

In crocodiles, only the posterior part of the nose is divided into two superimposed cavities; the upper represents the proper olfactory chamber,

2. Wiedersheim, R.: Comparative Anatomy of Vertebrates, edited by W. N. Parker, ed. 3, London, Macmillan & Co., 1907.

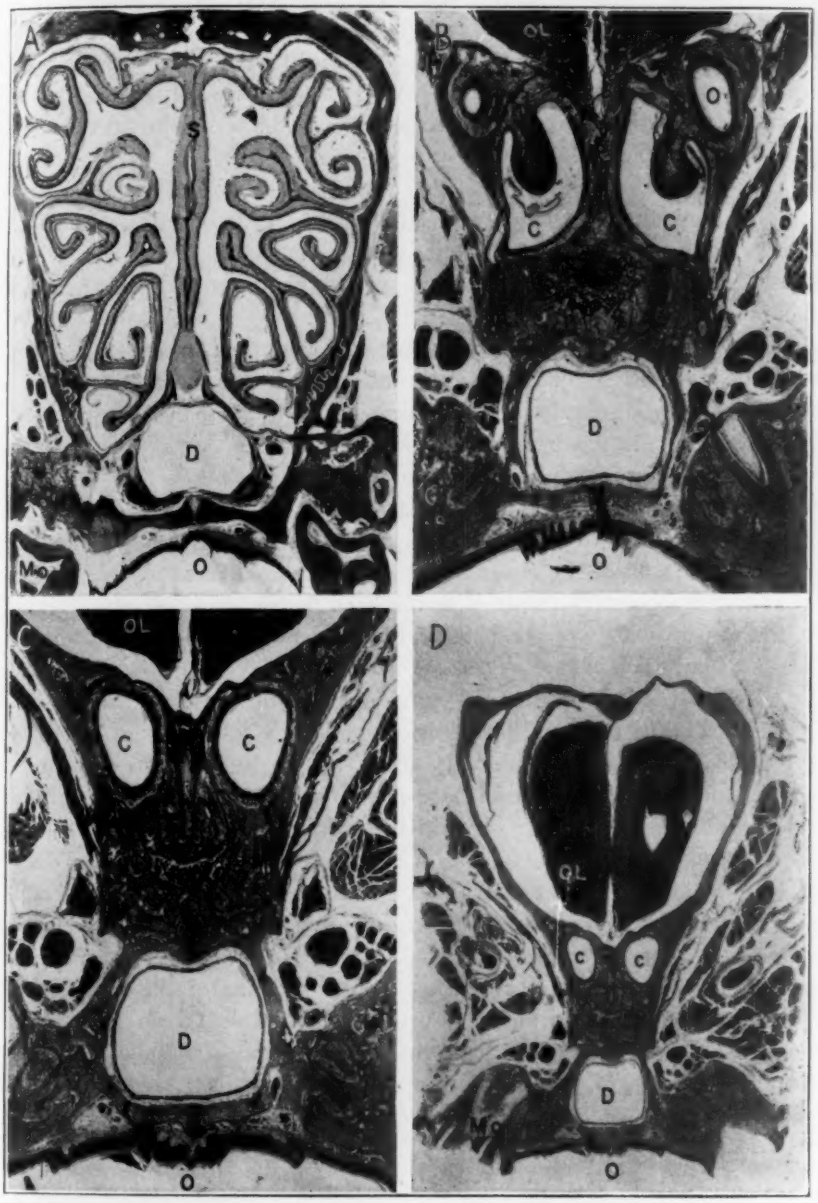

Fig. 2.—*A*, subseptal duct (*D*), round type. *B*, posterior part of the ethmoid portion of the nasal cavity. Note the posterior extremities of the fourth pair of endoturbinals protruding into the cul-de-sacs (*C*). *C*, disposition of the posterior nasal outlet. *D*, olfactory tract (*OL*); posterior nasal outlet.

lined by sensory epithelium, while the lower serves as a respiratory passage only (Wiedersheim-Parker). However, as pointed out by Romer,[3] the one conspicuous advance in crocodiles is the development of a hard palate. With these bipartitions within the nasal cavity, the food, respiratory and olfactory passages are strictly isolated. In the crocodile, Zuckerkandl [4] described a nasopharyngeal duct between the primary and the secondary choana.

In discussing the nasal cavity of the rat, Zuckerkandl mentioned the lamina terminalis, an osseous lamella on the ventral side of the ethmoid, separating the "upper space," the ethmoid labyrinth, from the "lower space," without going into detail about the conditions in the region of this lamina.

In considering the primary choana, the communication between the oral and the nasal cavity, it may be mentioned that the anterior orifice of the subseptal duct is located approximately at the site of this embryonal opening, indicating a relationship between them. However, the subseptal part of the duct is seen not only after birth but in the embryo as well after the sixteenth day above an already firmly built secondary palate. This is also noted in the case of the septal window forming the upper and anterior wall of the choana. Its appearance after complete development of the secondary palate is emphasized by the presence of a "raphe" at the upper surface of the palate, the nasal floor; this ridge forms the inferior boundary of the window.

The relationship of the subseptal duct to the nasopharyngeal duct warrants discussion. According to Gegenbaur's [5] description, the nasal cavity is developed considerably more in height in reptiles than in amphibians. In Testudines the respiratory section lies almost directly below the olfactory section, and in the respiratory section a fairly long nasopharyngeal canal originates. Gegenbaur has reproduced Seydel's [6] illustration, which shows clearly that this duct is located from its beginning behind the nasal passage and can be seen *after the septum has been removed*. Moreover, the original illustrations in Seydel's paper, e. g., figures 15, 21 and 23, representing frontal sections of the nasal cavity of Emys europea and lutraria, show clearly paired ducts. In his description the so-called nasopharyngeal ducts are tubular prolongations of the respiratory part of the nasal airways on both sides, seen in sagittal

3. Romer, A. S.: Man and the Vertebrates, ed. 3, Chicago, University of Chicago Press, 1941.

4. Zuckerkandl, E.: Das periphere Geruchsorgan der Säugethiere, Stuttgart, Ferdinand Enke, 1887.

5. Gegenbaur, C.: Vergleichende Anatomie der Wirbelthiere mit Berücksichtigung der Wirbellosen, Leipzig, Wilhelm Engelmann, 1898.

6. Seydel, O.: Ueber die Nasenhöhle und den Jacobson'schen Organ der Land- und Sumpfschildkröten, in Festschrift zum siebenzigsten Geburtstage von Carl Gegenbaur am 21. August 1896, Leipzig, 1896, vol. 2, pp. 385-486.

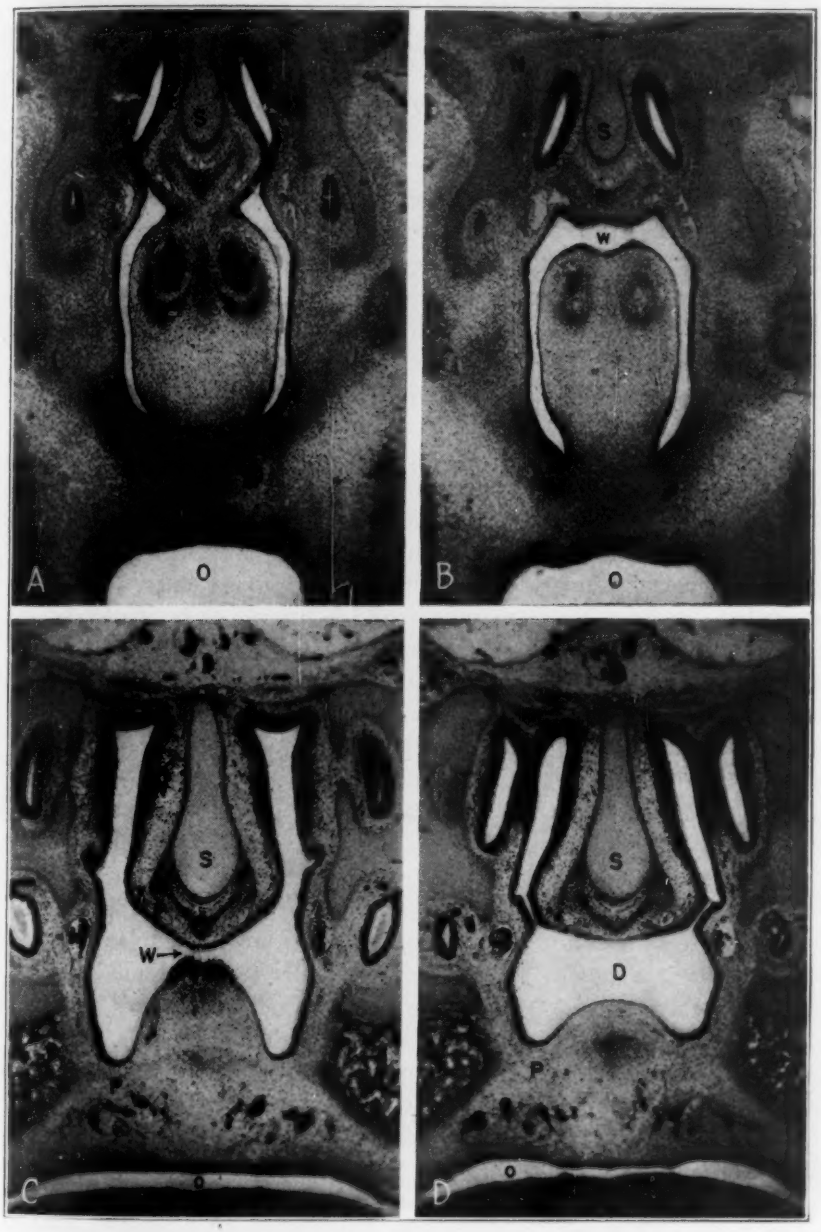

Fig. 3.—*A*, embryo of 16 days and 20 hours showing the beginning of the shelf formation between the septum and the lateral nasal wall. *B*, embryo of 16 days and 20 hours showing the septal window (*W*) in the choanal region patent. *C*, embryo of 18 days and 17 hours. The lower edge of the septum is broadening. *D*, embryo of 18 days and 17 hours. The raphe of the maxillas is flattened. The lateral shelves (the terminal laminas) are almost closed.

sections with the septum removed. In a model made by Seydel, in which the nasal cavity is shown from behind, the two parallel nasopharyngeal canals are drawn somewhat below and right and left from the nasal septum. They run separately through the entire length of the nasal cavity and are united to a single canal behind the internal nasal aperture. Even at this point the walls of this canal are formed only by soft parts, while osseous parts participate farther down in the pharynx.

Broman's [7] report presents a series of illustrations of reconstructed models. Eighteen of these, taken from the nasal passages of the rat, the guinea pig, the rabbit and the squirrel, show a nasopharyngeal duct or canal. Since his report is concerned only with the glands of the nasal cavity, no description of this canal is given and no conclusions are possible on the basis of the illustrations. The pictures represent sagittal views, and the relationship to the septum can be visualized with difficulty. It may be assumed at least in the case of Gegenbaur and of Seydel that they postulated the presence of a double canal, since the nasopharyngeal duct is shown following the removal of the septum. In the legends of Broman's illustrations the posterior canal is termed the nasopalatine duct as is, in the same picture, the incisive canal, and it is possible that this investigation assumes a continuation of one into the other, a condition somewhat similar to the connection found in crocodiles by Zuckerkandl, so seen between the primary and secondary choanae. It was emphasized on an earlier page that the anterior orifice of the subseptal duct is found at about the location of the embryonic primary choana. In this region a crossway, a concourse is formed, as the upper and the lower part of the nasal cavity, and the right and the left nasal airway open into each other at the same point, anterior to the nasal orifice of the subseptal portion of the pharyngeal duct.

In the rat a single central duct forms the initial part of the pharynx, replacing two parallel nasopharyngeal ducts divided by a thick septal partition. It extends the whole length of the ethmoid part far forward until it reaches a plane which is situated anterior to the ethmoid portion of the nasal cavity. Secretions from the anterior (respiratory) portion are directed posteriorly against the choanae, while secretions from the posterior (ethmoid) portion are conveyed anteriorly to reach the same outlet. Comparatively poor clearing of secretions of the posterior portion frequently results in a distinctly different pathology of the two parts (Kelemen and Sargent [8]).

The presence of lymphoid masses around the anterior orifice is better explained if one considers the duct as a prolonged pharyngeal

7. Broman, I.: Ueber die Entwickelung der konstanten grösseren Nasenhöhlendrüsen der Nagetiere, Ztschr. f. d. ges. Anat. **60**:439-586, 1921.

8. Kelemen, G., and Sargent, F.: Nonexperimental Pathologic Nasal Findings in Laboratory Rats, Arch. Otolaryng. **44**:24-42 (July) 1946.

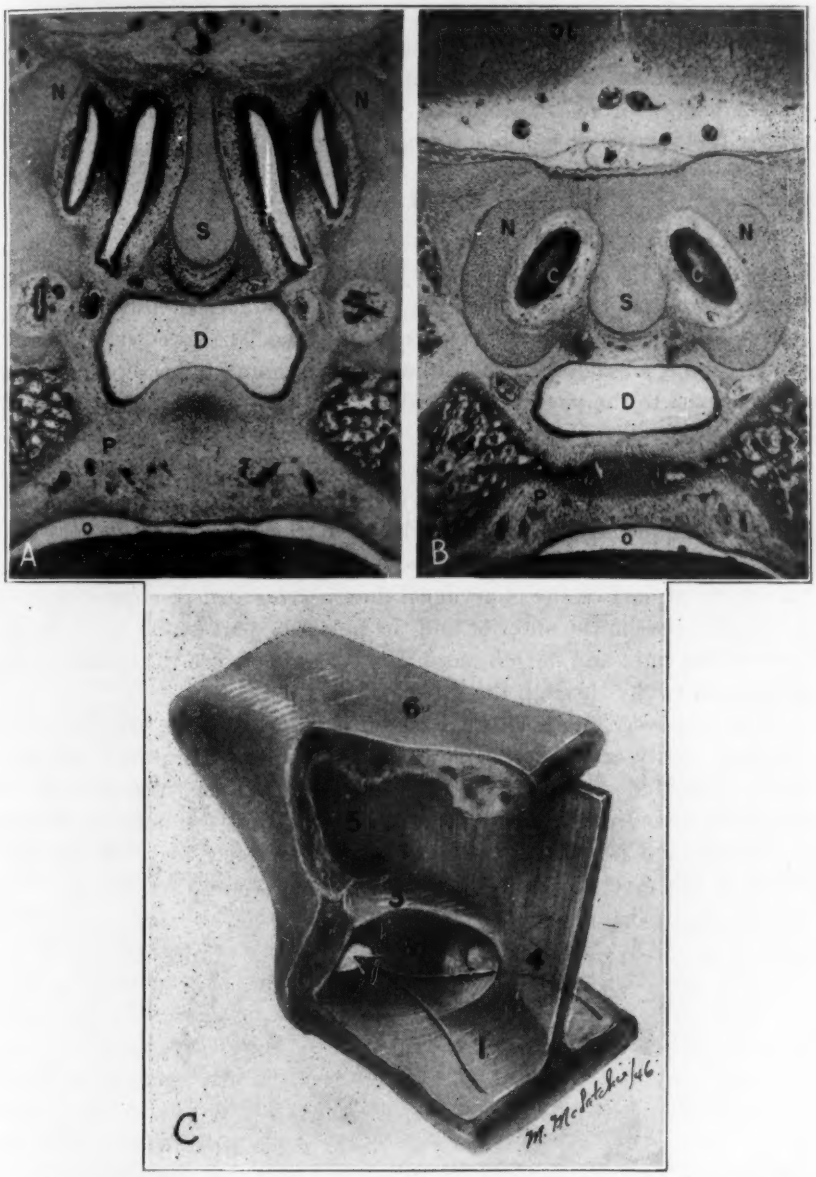

Fig. 4.—*A*, embryo of 18 days and 17 hours. The subseptal duct is formed (*D*). *B*, embryo of 18 days and 17 hours showing the posterior part of the nasal capsule (*N*) with cul-de-sacs (*C*). *C*, semidiagrammatic drawing. The lateral wall of the respiratory section is entirely removed, and that of the ethmoid section is partially removed. The arrow indicates the converging of the inferior meatuses of the respiratory section under the canopy of the terminal lamina and the orifice of the singular duct under the same shelf. In this diagram structures to be noted are numbered as follows.

1 floor of the respiratory section
2 floor of the ethmoid section
3 free edge of the terminal lamina, right side
4 septum of the respiratory section
5 septum of the ethmoid section
6 roof of the nasal cavity

tube. One is reminded of the lymphatic ring at the oral entrance of the nasopharynx. A pharyngeal canal prolonged into the center of the nasal cavity may be responsible for the presence of a great number of glands here. Broman mentioned that these glands provide moisture for all the surrounding tubular organs.

SUMMARY

Characteristic of the region of the choanae in the rat is a window in the septum of the lower (respiratory) portion of the nasal cavity, which represents a confluence of the two inferior meatuses of the respiratory half, immediately behind the vomeronasal organ. Covered by the bifurcating canopy of the terminal laminas which connect the septum of the ethmoid part to the lateral nasal walls, a tentlike antechamber is formed. The nasal opening of the pharyngeal duct is located under this roof. The duct extends forward the length of the ethmoid part between the lower edge of the septum and the secondary (hard) palate. This subseptal part forms a singular connecting duct between the nose and the pharynx.

In the region of the septal window, anterior to the nasal orifice of the subseptal part of the pharyngeal duct a crossroad of communication is formed between the anterior and the posterior part of the nasal cavity, between the right and the left nasal airway, and between the nasal and the pharyngeal cavity through the subseptal duct.

This crossway of the choanal region is situated in the very center of the nasal cavity at the boundary of the anterior (respiratory) and posterior (ethmoid) sections. This disposition effects peculiarities of clearance, since secretions must be conveyed from the anterior section posteriorly and from the posterior section anteriorly to reach the only outlet in the direction of the pharynx.

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STREPTOMYCIN USED IN THE TREATMENT OF SUPPURATIVE OTITIS MEDIA

A Preliminary Report

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AND
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A MULTITUDE of measures have been tried in the treatment of suppurative otitis media. None is entirely satisfactory. This is particularly true in cases in which the otitis is chronic. A large percentage of the ears in which the condition is refractive will be found to be infected with gram-negative bacilli, namely, Bacillus proteus and Pseudomonas aeruginosa. In ears from which these organisms were cultured, the results obtained with the usual methods of treatment in our hands, including the sulfonamide drugs and penicillin, have been consistently disappointing, though these same organisms are supposedly saprophytic. Often they must be pathogens.

Since gram-negative bacilli usually are resistant to sulfonamide compounds and penicillin in vitro and in vivo, streptomycin was tried in a small series of ears infected with gram-negative bacilli after their sensitivity to this antibiotic had been proved in the laboratory by other workers.

Streptomycin was used in a series of 20 cases of suppurative otitis media, representing 26 ears infected with gram-negative organisms. We were able to hospitalize all the patients, observe them daily and carry out such procedures as general physical and otolaryngologic studies, roentgen examinations of the mastoid processes and the sinuses, complete blood counts, serologic tests and cultures of material from the ears before and after treatment.

In 3 patients the otitis was acute; in 1 it had followed a traumatic rupture, and in 2 it had been treated unsuccessfully with penicillin previous to our study. In one of these, a 13 year old girl, definite tenderness had developed over the mastoid process in spite of the sulfadiazine and penicillin that had been given elsewhere. This patient also

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This work was performed as a part of the Clinical Cooperative Research Program on Streptomycin in the United States Marine Hospitals, of which Surgeon Luther L. Terry was the coordinator.

Summary of Data on Twenty Cases in Which Streptomycin Was Used in the Treatment of Suppurative Otitis Media Due to Gram-Negative Bacilli

Case	Ear Involved	Previous Surgical Intervention	Infecting Organism	Total Dose, Gm.	Condition Before Treatment	Condition After Treatment	Results *
1	Both	None	B. proteus P. aeruginosa	10	Profuse discharge bilaterally	Right, dry; left, slightly moist	+++
2	Both	None	B. proteus bilaterally	10	Profuse discharge bilaterally	Slight discharge	++
3	Both	None	P. aeruginosa, left B. proteus, right	20	Profuse discharge, left Slight discharge, right	Both dry; left dry in 10 days; right dry in 5 days; drums healed	Dry
4	Both	Mastoidectomy, right	B. proteus	20	Tenderness over mastoid process; left drum bulging; profuse discharge, right	Slight discharge, left Right dry	++ Dry
5	Right	None	P. aeruginosa	20	Profuse discharge, right	Dry	Dry
6	Left	None	P. aeruginosa	10	Moderate discharge, left	Dry	Dry
7	Left	None	B. proteus	20	Profuse discharge, left	Moderate discharge	+ —
8	Left	None	P. aeruginosa	30	Profuse discharge, left	Moderate discharge	+ —
9	Both	None	B. proteus P. aeruginosa	10	Profuse discharge bilaterally; right canal swollen; drum not visualized	Slight moisture bilaterally	++ ++
10	Right	Mastoidectomy	B. proteus P. aeruginosa	10	Profuse discharge, right	Dry	Dry
11	Left	None	P. aeruginosa	25	Moderate discharge, left	Slight discharge	++
12	Right	Mastoidectomy, age 6	B. proteus	20	Moderate discharge, right	Moderate discharge	+ —
13	Left	None	P. aeruginosa	35	Profuse discharge, left	Slight discharge	++
14	Left	Traumatic rupture of drum	P. aeruginosa	35	Profuse discharge, left	Slight discharge	++
15	Left	Mastoidectomy, left	B. proteus	25	Profuse discharge, left	Slight discharge	++
16	Right	None	P. aeruginosa	25	Moderate discharge, right	Dry	Dry
17	Both	None	B. proteus bilaterally	25	Profuse discharge	Slight moisture bilaterally	+++ +++
18	Left	None	P. aeruginosa	10	Profuse discharge	Dry	Dry
19	Right	None	B. proteus	25	Profuse discharge	Dry	Dry
20	Right	None	B. proteus	10	Moderate discharge	Dry	Dry

* "Dry" signifies that there is no discharge—excellent; +++, slight moisture—very good; ++, slight discharge—fair; +, moderate discharge—poor; + —, questionable improvement.

had purulent maxillary sinusitis and a large mass of adenoid tissue. She was treated with streptomycin and repeated myringotomy plus irrigation of the antrum and irradiation of the nasopharynx. The sinusitis and the tenderness of the mastoid region cleared, and the drainage from the ear diminished markedly. It was of interest to note that the opposite ear, which had been draining since the age of 6 months, dried completely in spite of the adenoid tissue. However, when the patient was seen for surgical adenoidectomy two months later, there was again slight discharging from both ears. We feel that surgical treatment may give her a chance for permanent drying of the ears.

The other patients, whose otitis was chronic, were all adults. Four had bilateral infections. Four had undergone mastoidectomy. Two showed hypertrophied lymphoid tissue in the nasopharynx, and the roentgenograms of all showed only more or less sclerosis of the mastoid processes. Other findings were noncontributory.

We were able to make tests for sensitivity to streptomycin in one third of our cases. In those in which there was a response, the sensitivity of the infecting organisms varied from 1 to 16 units per cubic centimeter. After treatment the organisms in the cases in which streptomycin failed to effect improvement proved to be resistant to 128 units per cubic centimeter. This, of course, is too small a number of cases from which to draw any conclusion, but it does suggest a rapid development of resistance to streptomycin.

Our routine treatment was carried out as follows: Two grams of streptomycin was given daily for five days. The 2 Gm. of the drug was dissolved in 24 cc. of sterile water and given in 2 cc. doses intramuscularly every two hours day and night. The ears were dried daily, and streptomycin drops (1 Gm. of the drug dissolved in 12 cc. of water) were instilled into the external canals hourly throughout the waking hours (twelve). The only other drug given was naphthylmethylimidazoline hydrochloride (Privine), which was administered in 0.05 per cent solution as nose drops when indicated.

All patients showed some improvement, and 6 ears dried within the five days. Thirteen of the remaining patients, with 15 affected ears, were given additional courses. Six of these received the original dosage of 10 Gm. in five days, while 7 were given 15 Gm. in five days (3 cc. at each injection). Of the 7 affected ears of the 6 patients, 3 became dry, and of the 8 affected ears of the 7 patients receiving 15 Gm., 2 dried.

Complete drying of all discharge occurred in 50 per cent of the infected ears in our series. Improvement was noted in 31 per cent. Nineteen per cent showed no improvement.

Though there was some discomfort at the site of injection, this caused no particular complaint, even in the 2 children studied in the series. No local reactions were encountered, and only 1 patient showed

a systemic reaction. This consisted of moderate swelling of the lips and the face after she had received the medication for nine and a half days. Streptomycin was discontinued, and the patient was given Benadryl (beta dimethylaminoethyl benzhydryl ether hydrochloride), 50 mg. four times daily. All symptoms subsided within twenty-four hours. It should be noted that this patient had a history of previous attacks of angioneurotic edema of the face.

Tinnitus, vertigo and neuropathies have been reported by others.[1] However, our patients were observed constantly, and though they received the drops directly into the ears, plus 2 to 3 Gm. intramuscularly for total doses of 35 Gm., no such complaints were encountered.

Now that streptomycin is becoming available to all, it is hoped that, with its wider usage, a correct treatment and dosage routine may be worked out, with a true evaluation of the effectiveness of the treatment. Since the antibiotic and the 3 cc. injection dose have been so well tolerated, and since we fear that the organisms may become resistant to streptomycin early, we personally plan to increase the dose for the initial course to a five day total of 15 Gm.

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1. Nichols, D. R., and Herrell, W. E.: Streptomycin, J. A. M. A. **132**:200-206 (Sept. 28) 1946.

MEASUREMENT OF THE OVERFLOW CAPACITY OF THE MAXILLARY SINUS AND ITS SIGNIFICANCE

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FOR MANY YEARS, during irrigations of the maxillary or the sphenoid sinuses, I have been measuring the amount of irrigating solution which the sinus would hold before overflowing. This I have called the overflow capacity. The procedure takes only a few seconds additional time and gives some information. If the sinus overflows at once, it is obvious that it is filled with pus, mucus, thickened mucous membrane, polypi, cysts, tumors or a combination of these. If the cavity of the antrum holds 12 or 15 cc. before overflowing, it is very likely a normal sinus.

Of course, this procedure is no substitute for roentgenograms or for roentgenograms taken with iodized poppyseed oil 40 per cent. In some cases it may be misleading. This is illustrated in the following case:

CASE 1

On April 18, 1945, C. P. S., an engineer 45 years of age, was seen with the complaint that he had suffered with generalized headaches at intervals for years. In the last month he had been having pain and tenderness over the right antrum and pain in the right upper teeth. He had been to his dentist, who reported the teeth normal. The right antrum was dark on transillumination. A roentgenogram of the sinuses was taken that showed "complete opacity of the right antrum indicative of heavy secretion and thickened membrane. The rest of the sinuses appear normal." The right antrum was irrigated through the middle meatus with a curved blunt cannula. On irrigation, the cavity overflowed at once, and a moderate amount of broken-down mucopurulent secretion was washed out. Three days later the right antrum was dark on transillumination and was irrigated again. To my surprise, the return flow was clear, and the cavity held 12 cc. before overflowing. Nine days later the patient stated that there was still much secretion from the nose, but no pain. The antrum was still dark on transillumination. On irrigation, the return flow was clear, and the cavity overflowed at 10 cc. Six months later the patient came in with the complaint that he still had headaches and thought the sinus probably was to blame. The antrum transilluminated normally. On irrigation, the cavity held 20 cc. before overflowing, and the return flow was clear. He was assured that the antrum could not be the cause of his headaches.

From the University of Southern California Medical School.

Read before the Western Section of the American Laryngological, Rhinological and Otological Society at Los Angeles, Jan. 27, 1946.

The antrum of this patient is unusually large, the average capacity being about 15 cc. Several things can be learned from this case. At the time of his second and third irrigations, when his overflow capacity was recorded as 10 and 12 cc. and the return flow was clear, there was, without doubt, 8 or 10 cc. of thickened, infected lining membrane in the cavity. The cilia were probably sweeping out the infected secretion as fast as it was formed. If a second roentgenogram had been made at this time, it would have shown this thickening. The dark transillumination and the excess drainage did give a hint that all was not well, and the patient was warned to have it examined again. When he did return, it was because of headaches (undoubtedly from some other cause). Now that his normal capacity is known to be 20 cc., future irrigations and overflow measurements, when and if he gets into more trouble, will be more informative.

I think one can also assume in this case that thickened, infected membranes of sinuses can and do return to normal with little help and without operative removal.

ANATOMY

The average normal capacity of the maxillary sinus as recorded by Skillern [1] is 10.12 cc. in women and 16.18 cc. in men. Paatero [2] measured the capacity of the antrums in a number of skulls of Laplanders and reported the average content was 13.75 cc. in men and 12.12 cc. in women. He also compared the capacity of the frontal sinuses with that of the antrums and found no uniform relation in their sizes. Seventy-five skulls were measured. Proetz [3] stated that the cubical capacity of the maxillary sinuses varies from 9.5 to 20 cc., with an average of 14.75 cc.

I have found the capacity of antrums to vary considerably, with probably an average of 12 cc. in women and 15 cc. in men. The largest capacities I have found were those of the antrums of a woman, one holding 20 cc. and the other 22 cc.

TECHNIC

Measurement of the overflow capacity of the maxillary sinus can be done easily whether the sinus is entered through the natural opening or through a puncture made in the inferior meatus. The only additional equipment needed is a 5 or 10 cc. glass syringe. If the cannula is fitted with a short piece of rubber tubing, the inside diameter of the tubing should be such that the syringe tip will fit properly. The capacity of tubing and cannula (or needle) should be measured by holding the

1. Skillern, R.: Catarrhal and Suppurative Disease of the Accessory Sinuses of the Nose, Philadelphia, J. B. Lippincott Company, 1913, p. 100.

2. Paatero, Y. V.: Size of the Maxillary Sinuses in Lapps, Duodecim **57**:491, 1941.

3. Proetz, A. W.: The Displacement Method of Sinus Diagnosis and Treatment, St. Louis, Annals Publishing Company, 1931.

point upward and injecting solution until it overflows. The amount is noted, usually 1 or 2 cc. if the tubing is the usual 4 or 5 inches (10 or 12 cm.) in length. This need be done only once.

After the antrum has been entered, the patient's head is inclined forward so that the floor of the nose tilts forward and fluid will flow easily forward into a basin. If the basin is painted black, the amount and the character of the secretion are more easily noted. The irrigating solution is then injected slowly until the first few drops roll out into the basin. A glance at the glass syringe tells how many cubic centimeters was injected before the cavity overflowed. The solution may then be aspirated for examination of the type of cells or for culture if desired. Then a large metal syringe may be used to finish the irrigation or, as some prefer, a pressure bottle may be used. The glass syringe alone may be used to finish the irrigation. Sometimes I have the patient hold the head well over on the shoulder in order to get the natural opening at the very top of the antrum. This may increase the overflow capacity 1 to 3 cc., depending on the shape of the upper antrum and the location of the natural opening. This is not done as a routine for several reasons. First, movement of the head with a cannula in the middle meatus is apt to produce pain. Second, the cannula may be dislodged. Third, many older patients have much difficulty getting the head over to the horizontal, and, fourth, it is harder to get the head in the same position on subsequent irrigations so that comparative measurements may be made.

Irrigation of the sphenoid sinus should be started with the head well back so that the first few drops go down the patient's throat. He is warned that this will happen and asked to make a sign, such as lifting a finger, when this occurs. With the head held back at about 45 degrees, the natural opening of the sphenoid is at its highest and the maximum overflow capacity is obtained. Incidentally it is a great help in deciding whether the cannula really is in the sphenoid sinus to be able to record an overflow capacity of a cubic centimeter or more.

Measurement of the frontal sinus is not practical but can be done by holding the head well over on the right shoulder for measurement of the right frontal sinus. The same position can be used to measure the capacity of an antrum which has had a window opening made in the inferior meatus. This occurred to me only recently but is possible and can be used to measure the increase in size of the cavity as thickening of the membrane subsides.

Another application of this technic recently occurred to me and has been tried a few times. After thorough irrigation of an antrum, the patient's head is turned well forward and over toward the opposite shoulder, and air is injected to displace all irrigating solution. A second overflow capacity measurement is made and compared with the first. The difference between the first and second measurements should give the amount of pus washed out and so help to estimate the amount of thickening or polypoid formation in the antrum.

A review of the literature for the last ten years and a check of the recent textbooks showed no mention of this procedure.

Peele and LeJuene [4] measured the amount of contrast medium required to fill the sphenoid sinus in 97 cases. Great variation in the size of the two sides was the rule. One sphenoid sinus held only a few drops, while the largest held 15 cc. The average amount held by both sphenoid sinuses in a single person was 10 cc.

4. Peele, J. C., and LeJeune, F. E.: Roentgenography of the Sphenoid Sinus, Laryngoscope **52**:522 (July) 1942.

CASE 2

Mrs. O. B. F., a woman of 35 years, was seen Sept. 28, 1945. She complained that a foul-smelling yellow secretion had drained from the left side of the nose for two years after the extraction of an upper left wisdom tooth. The left antrum was found to be dark on transillumination, and pus was seen in the left middle meatus. Irrigation of the left antrum was done through the middle meatus without obtaining a roentgenogram. The cavity overflowed at once, and there was much foul-smelling pus in the return flow. Roentgenograms of the teeth were obtained, which showed no evidence of involvement, and of the sinuses, which showed only the antrum to be infected. The patient was advised that because of the duration of the symptoms an operation would probably be necessary. She requested that irrigations be tried for a while. The second and third irrigation showed no change, but after the third irrigation the patient did not return for twenty-five days. She stated that she had had absolutely no discharge since the last treatment and could detect no odor. Irrigation of the antrum showed an overflow capacity of 8 cc., and the return flow was clear. She was advised to return in one month for another examination, as the transillumination was still dark and the overflow capacity was not up to the average. One month later transillumination was normal, and there had been no more drainage or odor.

CASE 3

L. S., a 13 year old boy, was seen in March 1943. He had had pain over the left frontal sinus for three days and excessive drainage from the left nostril for several months. The left antrum was dark on transillumination, and the roentgenograms showed the antrum and ethmoid cells to be very dark. On irrigation, a small amount of pus was washed out, but the overflow was immediate. Three days later, the cavity held 4 cc. before overflowing, and the secretion washed out was clumped rather than broken down. Three days later, the overflow capacity was 7 cc., and the return flow was clear. A roentgenogram taken after the next cold, eight months later, showed the sinuses normal except for a little thickening on the floor. The patient had no trouble for over a year, and then an attack developed which lasted two months in spite of frequent irrigations. The overflow capacity varied from 2 to 4 cc. Finally, when the mother was just about to take my advice and have a window opening made, the overflow capacity jumped to 16 cc., and the symptoms cleared up. I think the boy still needs a window opening (he was just in with another attack), but the fact that the antrum can return so nearly to normal is an indication that a Caldwell-Luc operation is not needed.

CASE 4

Mrs. E. B., a woman 60 years of age, was seen in April 1943. She stated that a window opening had been made in the right antrum by Dr. Hill Hastings many years before. She complained of a severe cold, with pain in the left antrum. The left antrum was dark, and after the acute symptoms had subsided it was irrigated through the middle meatus. The antrum overflowed at once, and much pus was washed out. Three days later the patient reported that there was no more pain in the left antrum. Irrigation showed an overflow capacity of 4 cc. The return flow contained clumped mucoid secretion. Two more irrigations were done at three day intervals, and the overflow capacities were 4 and 5 cc., with only a small amount of mucoid clumped secretion. On the next visit, three days later, the left antrum transilluminated normally, and irrigation was postponed. Five days later, seventeen days after the first visit, the antrum was irrigated, the return flow was clear and the overflow capacity was 13 cc. Transillumination was normal. A roentgenogram made a year later showed the antrum to be normal.

CASE 5 (CARCINOMA OF LEFT ANTRUM)

E. H. W., a man 55 years old, came into the office, Nov. 9, 1945, complaining of some swelling and slight tenderness over the left antrum which had lasted for several weeks. There had been no previous symptoms, and he had had no recent cold. The antrum was dark, and some yellow secretion was visible in the middle meatus. The wall of the inferior meatus bulged noticeably into the nose. A tumor was suspected. The antrum was punctured, 25 cc. of irrigating solution was slowly injected and there was still no overflow. It was assumed that the needle was in a tumor mass, and strong suction was applied as the needle was being moved in and out to secure a specimen by aspiration for biopsy. Enough cells were aspirated that Dr. Alvin Foord, our pathologist, was willing to make a diagnosis of carcinoma. A roentgenogram confirmed this, and operation was done by Dr. George Sharp for complete removal. Just where the 25 cc. of irrigating fluid went, I do not know. I suppose it infiltrated the soft tissues, but no noticeable swelling of the cheek or of the orbital contents occurred. I do not think the needle was in a vein; aspiration did not bring back blood. The patient complained of slight pain in the temple when the injection was started. The injection should have been stopped when no overflow occurred after a few cubic centimeters of solution had been injected.

CASE 6

L. S., a man 55 years old, came in, Dec. 3, 1945, with a complaint of gradually increasing nasal obstruction. His symptoms suggested nasal allergy but were not characteristic. Examination showed many polypi on both sides. The antrums were both dark on transillumination. Polypectomy was advised and done a week later. Immediately after removal of the polypi, both antrums were irrigated through the middle meatus and the overflow capacities measured. Both overflowed at about 4 cc. The return flow brought out less than a cubic centimeter of mucoid clumped secretion from each side. The right sphenoid sinus was irrigated, and the overflow occurred at 7 cc. The return flow was clear except for a tiny mucoid clump. The left sphenoid opening was not found. A smear of the mucus from the sphenoid sinus showed many eosinophils and no pus cells.

It was assumed that this patient's polypi were allergic and that the antrums were filled with allergic polypi or thickened lining membrane. He was advised that unless infection developed, it was not necessary or wise to operate in any way on his sinuses. A fairly accurate picture of the status of his sinuses was obtained without the expense of roentgen examination. Since he was a working man with a low income and a large family, he appreciated this.

CONCLUSION

Measurement of the amount of irrigating solution which a sinus will hold before overflowing is of some diagnostic value. This has been called measurement of the overflow capacity. It is of special value in estimating the amount of thickening present in chronic sinusitis, especially of the maxillary sinus.

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ROLE OF COLUMELLAR AND SEPTOCOLUMELLAR SUTURES IN RHINOPLASTY

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TO OBTAIN a natural looking and esthetically pleasing nose is one of the most difficult accomplishments in the field of rhinoplastic surgery. Not only must the nose be pleasing to look at, but the result can be considered adequate only when the trained observer is unable to detect the reconstruction. In the article "Introduction of an Artistic Point of View in Regard to Rhinoplastic Diagnosis,"[1] great emphasis is laid on some of the outstanding faulty end results of nasal reconstruction. About 90 per cent of all artistic errors are centered around the nasal tip, involving the columella, the nostrils, the septolabial angle and the philtrum.

The basic steps in the classic operation are: (1) separation of the soft tissues of the nose, (2) transsection of the membranous septum down to the anterior nasal spine of the maxilla, (3) correction of the bony vault, (4) reduction of the septum and of the upper lateral cartilages, (5) modeling of the lower lateral cartilages and (6) reattachment of the columella to the septum. In carrying out step 6 the haphazard use of septocolumellar sutures without careful planning is the greatest contributing cause in the production of postoperative monstrosities.

In nasal reconstruction a good nasal tip depends on a number of factors. They may be enumerated as follows:

1. Correct artistic evaluation and analysis.
2. Proper surgical procedure and good technic.
3. Elasticity and tone of the soft tissues of the nose.
4. The judicious and correct use of columellar and septocolumellar sutures.

Assuming that factors 1 and 2 have been correctly executed, this article deals only with the columellar and septocolumellar sutures used in obtaining an artistic nasal tip. It can be truly said that no postoperative result can be considered adequate without a good nasal tip; hence the importance of meticulous attention to every detail in the surgical correction of the tip.

How can one avoid these deformities? Correct artistic evaluation and analysis, proper surgical procedure, good technic and the condition

1. Daley, J.: Introduction of an Artistic Point of View in Regard to Rhinoplastic Diagnosis, Arch. Otolaryng. **42**:33 (July) 1945.

of the tissues are all very important. Since one or more of these factors are often lacking or difficult to attain, the proper use of columellar and septocolumellar sutures will aid in producing the desired result. On the other hand, improper use of these sutures may mar a well executed rhinoplasty. To depend on sutures alone is a fatal mistake. If all conditions and procedures were perfect, no sutures would be necessary. Since it is almost impossible to have such an ideal situation, the aim of the surgeon should be to procure an artistic tip with as few sutures as possible.

Why should sutures for correcting the nasal tip be used judiciously? Because under ideal conditions sutures should never be used under tension, and their main purpose should be gentle apposition. As soon as they are put under tension in an attempt to obtain certain morphologic effects, one pays a price. That price is distortion of the neighboring structures due to forcible depression, elevation or torsion of the tissues. Therefore one may readily see that sutures used not for mere apposition of tissues but for the purpose of changing the form or the position must of necessity be put in place with a minimum amount of tension. It must also be remembered that the mechanical effects of the sutures depend not only on the position of the sutures but also on the amount of tissue between the sutures and the relative position of the ends before tying, as well as on the amount of tension used. The slightest amount of tension must produce at least a proportionate amount of the desired effect. If the suture cannot stand this test, it is better to eliminate it entirely. Often a combination of columellar and septocolumellar sutures is employed, and this is where the ingenuity and the imagination of the surgeon is taxed to the extreme. The columellar and septocolumellar sutures used are as follows:

1. Orthopedic suture of Joseph.
2. Columellar belly suture.
3. Submerged perforating suture.
4. Straight septocolumellar suture.
5. Ventral septocolumellar suture.
6. Straight columellar suture.
7. Perforating implantation suture.

ORTHOPEDIC SUTURE OF JOSEPH (FIG. 1)

The purpose of this suture is to elevate the tip of the nose after the septum has been shortened. A heavy silk suture is passed through the septal cartilage and the columella in an oblique fashion, so that when the suture is tied, the mobile tip of the nose is projected forward and upward, the fixed septum acting as a fulcrum (fig. 1 *A* and *B*). This valuable suture should be used only when the tip of the nose remains dependent after the septal shortening. Unfortunately, when this suture

is indicated and used, it is often accompanied by much distortion, which I believe is due to improper application of the suture. The great fault lies in the fact that too great a "bite" of the columella is taken. When this suture is tied, the elevation of the tip is accompanied by a tightening and a straightening of the columella, and thus one deformity is substituted for another (fig. 1 *B*). Without proper planning, too much tension may be used to get the desired elevation of the tip, so that frequently the distortion may include the septolabial angle as well. One must remember that this suture should not be used when the nasal tip, owing to the elasticity and the tone of the soft tissues, springs into proper elevation. When its use is indicated, however, it should be used with

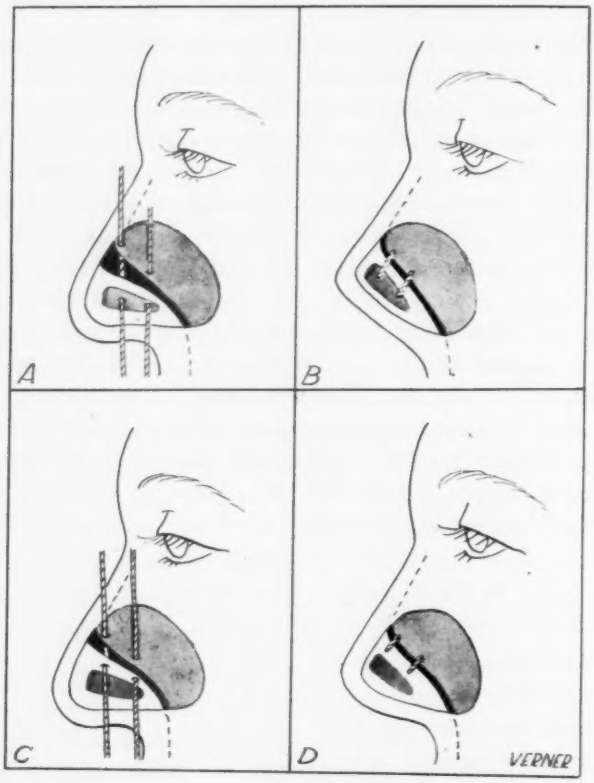

Fig. 1.—Orthopedic suture of Joseph: *A*, the orthopedic suture before tying. Note the big bite of the columella.

B, orthopedic suture after tying. Note the deformity of the columella and of the septolabial angle.

C, modified orthopedic suture before tying. Note the small bite of the membranous septum.

D, modified orthopedic suture after tying. Note the minimum amount of distortion.

extreme care, so that the proper amount of elevation can be obtained without too much tension and with as little strangulation of the columellar tissues as possible (fig. 1 *C* and *D*). This suture should rarely be used alone. When it is applied in conjunction with other columellar and septocolumellar sutures the desirable mechanics is greatly enhanced.

COLUMELLAR BELLY SUTURES (FIG. 2)

To avoid a tightening of the columella in using the orthopedic suture, I have employed what I call a columellar belly suture. This is an anteroposterior interrupted through-and-through suture of the columella such that when it is tied a belly-like effect of the columella is produced. This suture is placed approximately at the center of the columella, and the amount of the bellying effect depends on the size of the "bite." This may

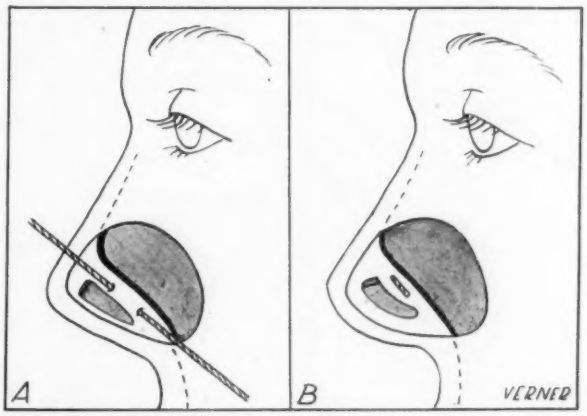

Fig. 2.—Columellar belly suture: *A*, before tying; *B*, after tying. Note the bellied effect of the columella.

be used before the orthopedic suture is employed, and the purpose is to preserve the graceful curve of the columella. One notes that in this instance an attempt is made to get the desired effect by deliberate strangulation of the columellar tissue. On occasion, this suture may be used after the orthopedic suture is placed in position. It goes without saying that the columella should be of sufficient length to withstand this manipulation.

SUBMERGED PERFORATING SUTURE (FIG. 3)

The technic of this suture was described in an earlier article.[2] It is used mainly for the correction of a wide or a webbed septolabial angle due to the unavoidable distorting effect of the orthopedic suture of Joseph.

2. Daley, J.: Retaining a Correct Septolabial Angle in Rhinoplasty, Arch. Otolaryng. **39**:348 (April) 1944.

It may be used in a preoperative wide septolabial angle as well. The technic of the suture can be described briefly as follows: A needle threaded with a no. 00 silk suture is introduced through the dorsocaudal end of the septal cartilage (fig. 3 *A*) and then made to pass between the mesial crura and out through the columellar skin. The course of the suture is then retraced through the perforation in the skin of the columella, back again between the mesial crura, out through the opposite

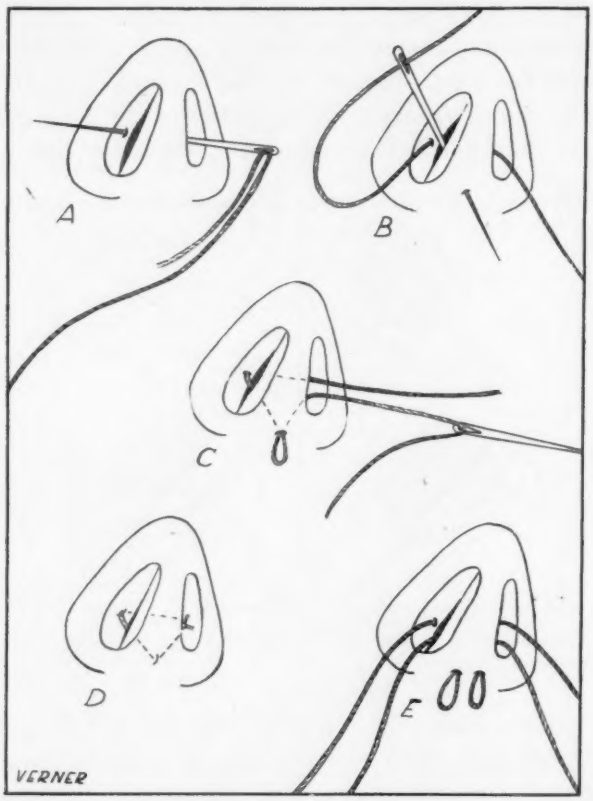

Fig. 3.—Submerged perforating suture (basal view of nose): *A*, needle introduced through the dorsocaudal end of the septal cartilage.

B, suture passed between the crura and out through the columellar skin.

C, suture retraced through the perforation in the skin back again between the crura.

D, suture tied.

E, introduction of two septolabial sutures before tying.

nostril and tied (fig. 3 *B* and *C*). The external loop disappears in the puncture of the skin, but it catches enough subcutaneous tissue to hold the columella and the lip firmly in the proper position and so obliterates the wide septolabial angle (fig. 3 *D*).

I have since modified this suture. The natural asymmetry and uneven thickness of the tissues of the septolabial angle may vary to such an extent that the suture must be placed to one side of the midline, and at times more than one suture is required to get both symmetry and a good septolabial angle simultaneously (fig. 3*E*).

STRAIGHT SEPTOCOLUMELLAR SUTURE (FIG. 4)

In a young subject, in whom the elasticity and the tone of the soft tissue are good, the tip will spring into proper position. Under these circumstances the orthopedic suture is contraindicated, and the straight septocolumellar suture is substituted in its place. This suture is passed through the septal cartilage and the columella in a straight fashion, unlike the orthopedic suture, which is passed through obliquely. Here, too,

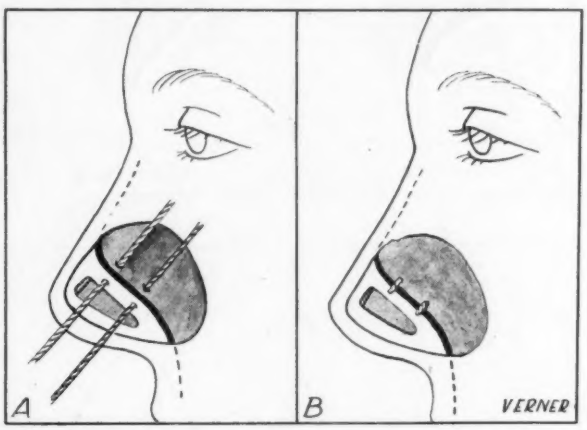

Fig. 4.—Straight septocolumellar suture: *A*, before tying; *B*, after tying. Note that there is no distortion.

one must avoid taking too big a "bite" of the columella, the sole function of the suture being to appose the margins of the septocolumellar incision. Under these circumstances one may be sure that the results will be uniformly good.

This suture is also useful in combination with the ventral septocolumellar suture (described later on), which can be used to overcome a "polly beak" effect.

VENTRAL SEPTOCOLUMELLAR SUTURE (FIG. 5)

After a reconstruction or the use of the orthopedic septocolumellar suture, a "polly beak" effect is occasionally noted. To eradicate this deformity is difficult and often an exasperating experience. The proper placement of a ventral septocolumellar suture will at times be of great

help in overcoming the deformity. The suture is carried through the most ventral margin of the cartilaginous septum as high as possible and then carried through the most ventral attachment of the columella (fig. 5 *A*). It is really carried to the anterior angle of one nostril and out through the other nostril and tied. The effect of this suture is to draw

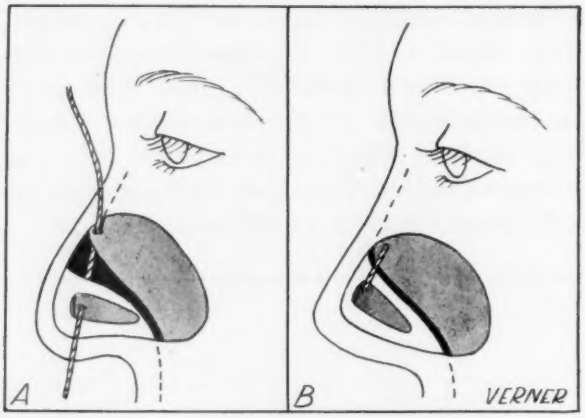

Fig. 5.—Ventral septocolumellar suture: *A*, before tying. Note the "polly beak." *B*, after tying. Note obliteration of the deformity.

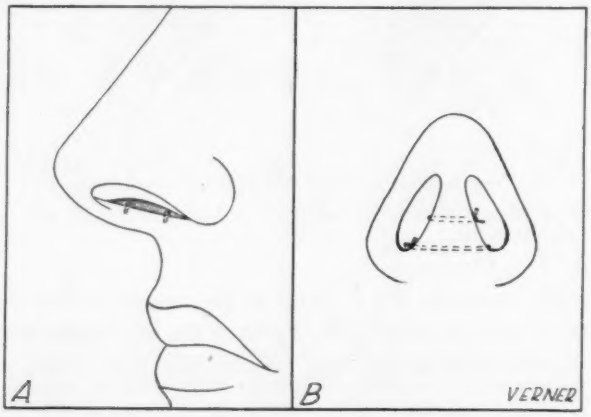

Fig. 6.—Straight columellar suture: *A*, lateral view; sutures tied. *B*, basal view; sutures tied.

the extreme tip of the nose up on the septum and in this way remove the "polly beak" effect (fig. 5 *B*). A square tip, which is desirable in certain types, may be obtained by combining this suture with a straight septocolumellar suture. Much patience is necessary in getting the most out of this suture. It is not an easy manipulation, and many attempts may be necessary before the desired action of this suture is obtained. Unlike the orthopedic septocolumellar suture, which swings the whole

tip and the columella forward and upward, this suture elevates only the tip of the nose in an upward direction, in line with the dorsum of the nose.

STRAIGHT COLUMELLAR SUTURE (FIG. 6)

The straight columellar suture is simply a straight interrupted suture for the closure of the crura of the columella. After a columella has been narrowed by removal of the excess tissue or after one has been widened

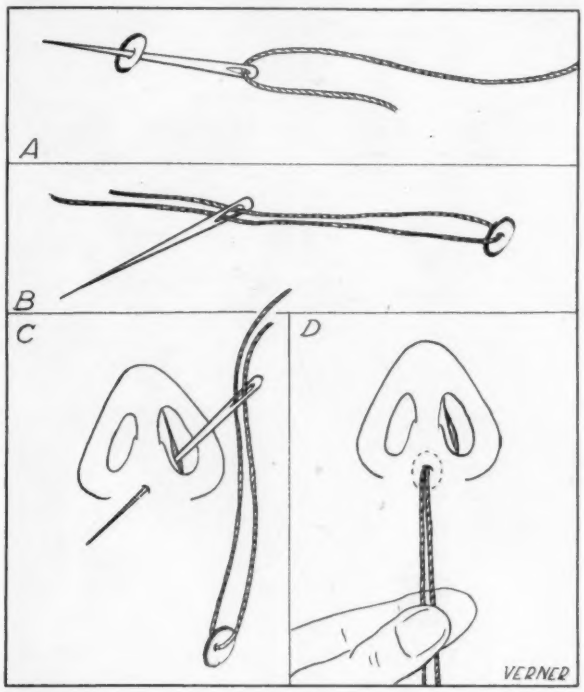

Fig. 7.—Perforating implantation suture: *A,* cartilage implant impaled on suture needle.

B, both ends of suture threaded through the needle.

C, suture made to pass between the crura and out through the skin of the columella.

D, holding the implant in position.

by means of an implant, the sutures used to appose the crura should be placed at the extreme margins of the line of the incision (fig. 6 *A*). This prevents strangulation of tissues and preserves the natural contour of the columella. One can easily see how a combination of the perforating implantation suture (described later on) and the straight columellar suture simplifies as well as improves the technic of the correction of columellar deformities.

PERFORATING IMPLANTATION SUTURE (FIG. 7)

The implanting of cartilage at the septolabial angle or between the mesial crura of the columella is often an awkward and time-consuming procedure. Considerable difficulty may be encountered in maintaining a small bit of cartilage in proper position in its bed while the tissues

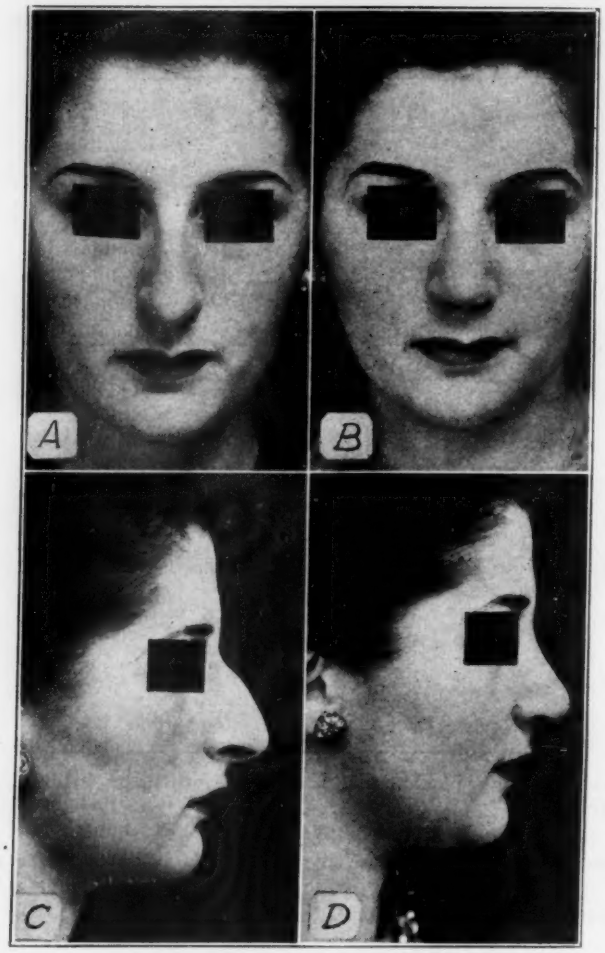

Fig. 8 (case 1).—Improper use of the septocolumellar sutures: *A*, before; *B*, after; *C*, before; *D*, after. Note the rigid appearance of the columella, the wide septolabial angle and the unnatural looking tip.

are being manipulated. Frequently the implant is lost in the tissues, and much time is wasted in trying to retrieve it. This suture was devised so that the cartilage might be easily held in position or removed without the usual fuss and bother. The implant is impaled on a no. 00 or no. 000 silk suture (fig. 7*A*). Both free ends are then threaded on a

straight skin needle (fig. 7 *B*), and the needle is made to pass between the mesial crura and out through the columellar skin (fig. 7 *C*). The double suture is used as an anchor suture while the bed is closed. This is accomplished by holding the suture taut, immobilizing the implant and maintaining it snugly in its bed (fig. 7 *D*). After the crura of the

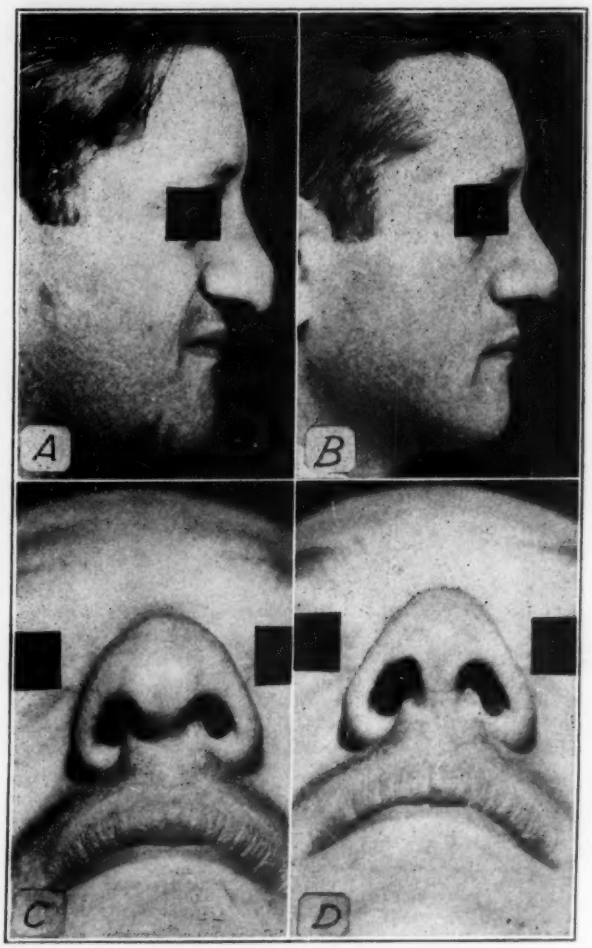

Fig. 9 (case 2).—Proper use of the septocolumellar sutures: *A*, before; *B*, after. *C*, before; *D*, after.

columella are sutured, one arm of the suture is cut close to the skin and the whole suture is pulled out, leaving the implant safely in the desired position. If, however, the occasion should arise that one desires to replace or change the position of the implant, all that is necessary is to pull out the suture with the impaled bit of cartilage, without the necessity of "fishing" for it. This method of handling cartilage implants in

the columella and the septolabial angle is a really practical procedure and facilitates the correction of a retracted or a narrow columella or an acute septolabial angle.

Experience has proved that the best results are obtained when the sutures are under as little tension as possible. When the tissues are

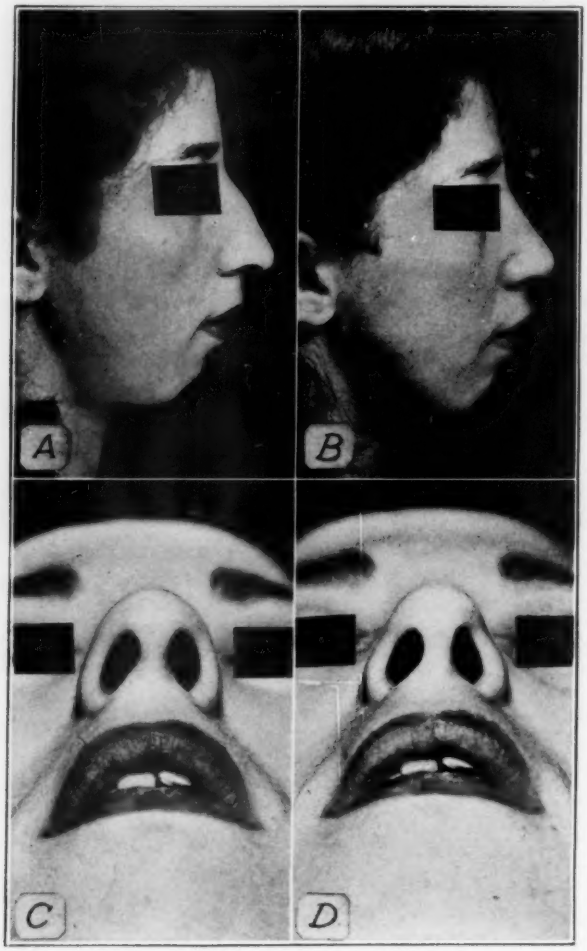

Fig. 10 (case 3).—Proper use of the septocolumellar sutures: *A*, before; *B*, after. *C*, before; *D*, after. Note the marked receding chin, to be corrected later on.

elastic and have good tone, tension sutures are not necessary—the fewer the sutures, the better. When using more than one septocolumellar suture, always plan to alternate the knots so that all the sutures will not be tied on the same side. The combined pull of all the sutures being tied on one side causes buckling with accompanying distortion. I am including the photographs of some recent subjects of plastic surgery to

show the results that may be obtained through the proper use of columellar and septocolumellar sutures. It will be noted in figures 9, 10, 11 and 12 that the proper use of the sutures results in a natural looking nose. The columella is bellied and graceful, the septolabial angle is correct and there is no distortion of the nasal tip. Figure 8, however,

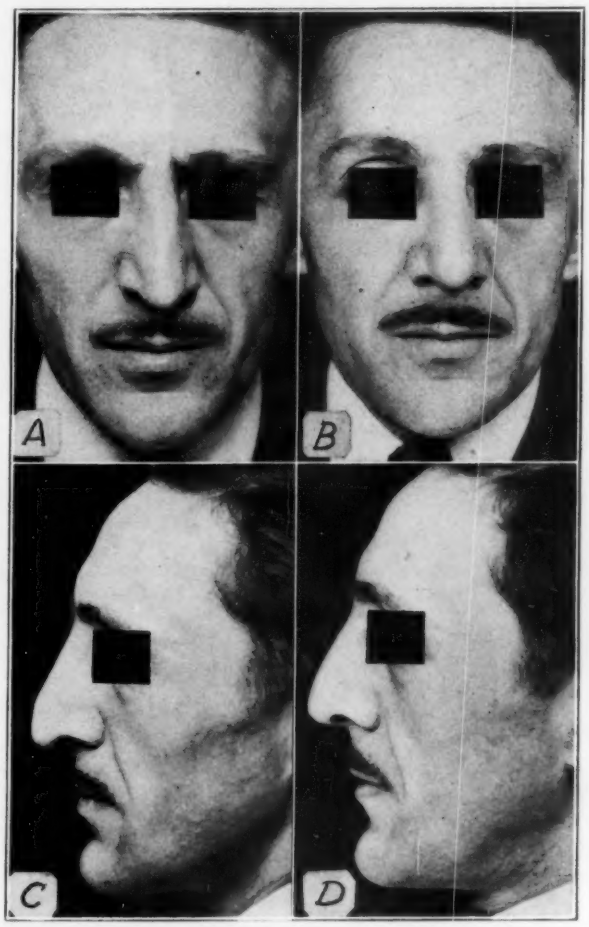

Fig. 11 (case 4).—Proper use of the septocolumellar sutures: *A*, before; *B*, after. *C*, before; *D*, after.

shows the improper use of the septocolumellar sutures. Note the taut, rigid appearance of the columella, the wide septolabial angle and the unnatural-looking tip. In this case the orthopedic septocolumellar suture was put under too great tension and too great a "bite" of the columellar tissue was taken.

In conclusion, let me emphasize the fact that even the most scrupulous technic is not the solution for getting the best results. Diagnosis, artistic judgment and the faculty of being able to improvise are essential to avoid failure. Let me repeat that when the natural elasticity and tone of the tissues are present, one may be sure that the result will be most

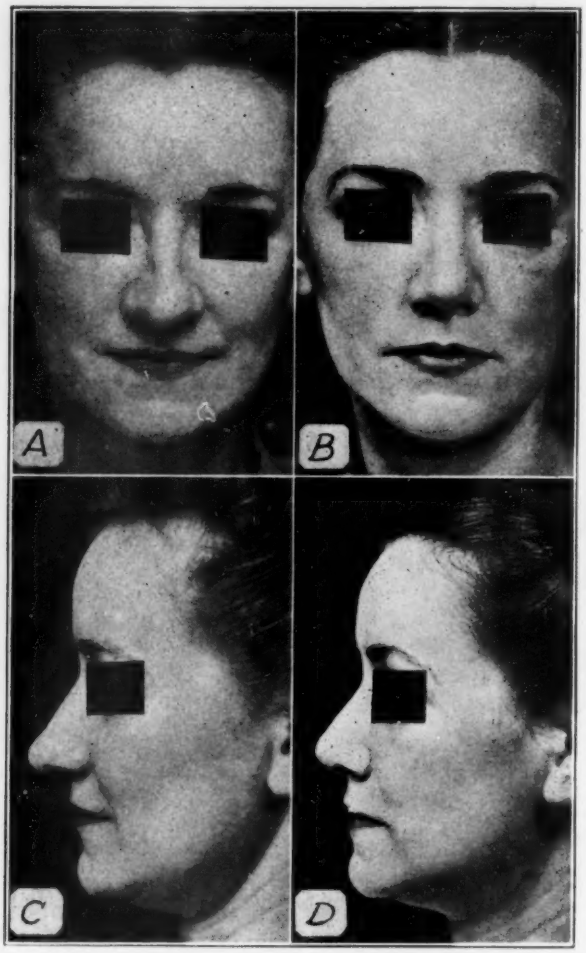

Fig. 12 (case 5).—Proper use of the septocolumellar sutures: *A*, before; *B*, after. *C*, before; *D*, after.

gratifying. Finally, the general rule to follow should be: "The fewer the sutures, the better. The ideal rhinoplasty is the one that employs no tension sutures at all."

The drawings used in illustrating this article were made by Jeanne Verner. 104 East Fortieth Street.

DENTAL TREATMENT OF TRISMUS, TINNITUS, OTALGIA AND OBSCURE NEURALGIAS

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THE DENTAL measures reported here have been used in 30 cases to treat conditions producing symptoms of altered function of the temporomandibular articulation. The procedures used and a discussion of possible reasons for the success obtained are presented.

ANATOMIC CONSIDERATION

While an extensive anatomic consideration of this articulation is not necessary (a complete discussion being found in any of the standard textbooks of anatomy as well as in other sources [1]), it is important to examine the intimate relation of nearby structures and their possible involvement in condylar malposition.

The process gracilis of the malleus and the tympanic branch of the internal maxillary artery are lodged in the petrotympanic fissure. In the medial end of the fissure is the canal of Huguier containing the chorda tympani nerve. The auriculotemporal nerve passes close to the mesial side of the joint capsule, between the condyle and the tympanic plate to be distributed over the temporal and vertical region.

It has been pointed out [2] that the manner in which the mandible is attached to the skull provides obvious chances for the condyle to impinge on sensory nerve branches. Mesially it may irritate the chorda tympani

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This article has been released for publication by the Division of Publications of the Bureau of Medicine and Surgery of the United States Navy. The opinions and views set forth are those of the writers and are not to be considered as reflecting the policies of the Navy Department.

1. Shapiro, H. H., and Rogers, W. M.: Anatomy of the Temporomandibular Articulation, Arch. Clin. & Oral. Path. **3**:5 (March) 1939. Prentiss, H. J.: Regional Anatomy, Emphasizing Mandibular Movement with Specific Reference to Full Denture Construction, J. Am. Dent. A. **10**:1085 (Dec.) 1923. Lord, F. P.: Movements of the Jaw and How They Are Effected, Internat. J. Orthodontia **23**:557 June) 1937.

2. Costen, J. B.: Diagnosis of Mandibular Joint Neuralgia and Its Place in General Head Pain, Ann. Otol., Rhin. & Laryng. **53**:655 (Dec.) 1944.

where it passes out of the glenoid fossa through the petrotympanic fissure. Posteriorly it may cause the auricular branches of the auriculotemporal nerve to become impacted within the articulation, and with wider, loose movement the condyle may irritate the auriculotemporal nerve itself. When sufficient destruction of joint structures occurs and allows the eroded face of the condyle to rest against the tubercle of the glenoid fossa, an abundant source of reflex pain is created.

SURVEY OF THE LITERATURE

Dental correction of these disturbances has been extensively discussed in the dental literature. Prentiss,[3] Goodfriend,[4] Wright,[5] Monson[6] and many others[7] have described the anatomy of this region, the symptoms occurring as a result of mandibular malposition and methods of treatment. An otologist, Costen,[8] grouped the most common symptoms, and this grouping is called Costen's syndrome. They are: pain and discomfort while chewing; difficulty in opening and closing (trismus); cracking noises in the joint during movement; obscure neuralgias in and about the head; symptoms referable to the ear, such as pain, tinnitus and deafness.

He demonstrated in another paper[9] that all or part of these symptoms may be considered of common occurrence and that a dental investigation should be made in any case of facial pain or headache not referable to other sources. He described a series of 400 cases of reflex pain attributed to disturbances of the mandibular joint and grouped

3. Prentiss, H. J.: Preliminary Report upon Temporo-Mandibular Articulation in Human Type, Dent. Cosmos **60**:505 (June) 1918.

4. Goodfriend, D. S.: Symptomatology and Treatment of Abnormalities of Mandibular Articulation, Dent. Cosmos **75**:844 (Oct.) 1933.

5. Wright, H. W.: Deafness as Influenced by Malposition of the Jaws, J. Am. Dent. A. **7**:979 (Dec.) 1920.

6. Monson, G. S.: Occlusion as Applied to Crown and Bridge-Work, J. Nat. Dent. A. **7**:399 (May) 1920.

7. Schopper, A. F.: Lost Vertical Dimension: Causes and Effects; Diagnosis and Various Treatments Recommended, J. Missouri Dent. A. **18**:217 (Nov.) 1938. Conners, M. C.: Tissue Reactions in Temporomandibular Articulation Following Loss of Teeth, Dent. Cosmos **67**:124 (Feb.) 1925. Chor, H.: Neurologic Aspects of Temporomandibular Disorders, J. Am. Dent. A. **25**:1033 (July) 1938. Bleiker, R. F.: Ear Disturbance of Temporomandibular Origin, ibid. **25**:1390 (Sept.) 1928. Summa, R.: Importance of Inter-Articular Fiber Cartilage of the Temporomandibular Articulation, Dent. Cosmos **60**:512 (June) 1918. Edmund, P. A.: Restoring Lost Vertical Dimension, J. Am. Dent. A. **25**:849 (June) 1938.

8. Costen, J. B.: Syndrone of Ear and Sinus Symptoms Dependent upon Disturbed Function of the Temporomandibular Joint, Ann. Otol., Rhin. & Laryng. **43**:1 (March) 1934.

9. Costen, J. B.: Diagnosis of Mandibular Joint Neuralgia and Its Place in General Head Pain, Ann. Otol., Rhin. & Laryng. **53**:655 (Dec.) 1944.

them as follows: otalgia, 152; orbital, buccal or parietal pain, 107; glossodynia, 92; vertical, occipital or cervical pain, 91.

Pippin[10] reported that in a series of 100 patients treated under careful supervision a change in condylar position had been shown by serial laminagraphic studies and stated that all these showed "definite improvement when treated for correction of condylar malpositions" and that 90 per cent, including 3 whose disease was diagnosed as trigeminal neuralgia, "were completely relieved of their symptoms."

Anatomic consideration of the articulation and analysis of the available literature disclosed an important fact, namely, that the symptoms of Costen's syndrome are initiated by movements of the mandible.

The next determination was that we were dealing with motion and that an attempt to approach the problem from a static concept might end in failure.

EXPERIMENTAL TECHNIC USED

After selection of a patient with some or all of the symptoms of Costen's syndrome and after obvious medical factors had been ruled out, a series of intraoral roentgenograms was taken to eliminate the possibility that foci of infection were the causative agents.

With a suitable material, impressions of both jaws were taken and casts run up in stone. It was then necessary to select an instrument on which the models could be placed so that the relationship of the jaws could be studied when they were in motion.

Because the temporomandibular articulation is an arthrodial diarthrosis, its movements are necessarily complex, and no instrument has yet been developed that fully reproduces all these movements.

The Hanau articulator, a device of both simplicity and accuracy, was selected because it produces movements equivalent to those of the mandible, and it proved satisfactory for the purpose.

The next step was to transfer the upper cast to the articulator with the aid of a face bow. The purpose of this was to have the upper cast in the same relation to the hinge of the articulator as the maxilla is to the temporomandibular articulation.

The method of mounting the lower cast is important in that all registrations should be taken in unstrained positions to insure the greatest possible accuracy. This is necessary because the magnitude and the direction of forces and their points of application are beyond the control of both the operator and the patient. It is logical to assume, therefore, that methods of recording the relationships of jaws that are under pressure are apt to be unreliable. Of all the magnitudes, directions and points of application of forces which a patient can possibly exert when

10. Pippin, B. H.: Treatment of Temporomandibular Lesions Caused by Dental Mutilation, Illinois Dent. J. **10**:15 (Oct.) 1943.

closing the mouth, there is only one reliable and definite combination, the magnitude of the force zero, a force which has no direction and no point of application.

With this in mind, the patient was placed in a relaxed upright position, instructed to swallow, open his mouth to a rest position and allow a thin piece of low-fusing wax to be inserted between the teeth; he was then instructed to close gently until the first point of contact was made through the wax by two or more opposing teeth, but no further closure was permitted. The wax was then chilled and carefully removed. This was repeated until two or more "bites" agreed.

It is realized that biting into wax requires the application of some force, and in order to reduce this as much as possible, a very soft heated wax was used and the patient instructed to close gently.

The condylar paths on the articulator were then set by having the patient protrude the lower jaw and having new wax registrations made while it was in this position, the articulator being adjusted accordingly. (This step was of course omitted when impracticable or impossible, as in trismus.) Lateral settings on the articulator were determined by the formula

$$L = \frac{H}{8} + 12$$

where

L = the lateral inclination of the condyle in degrees;

H = the horizontal inclination of the condyle in degrees as established by the protrusive relation.

(A full explanation of the operation of this formula is contained in the instruction book [11] accompanying each Hanau articulator.)

A study was then made of this relationship on the articulator. The points of premature contact were marked and compared with corresponding points in the mouth. The models were then run through all paths of excursion, and any point of interference was noted.

These points were then checked with those in the mouth by having the patient duplicate the movements with carbon paper between the teeth. The inclined planes of the teeth around the point of premature contact were studied both on the models and in the mouth. Then, with a small stone interfering, inclined planes were reduced in an effort to provide unhampered mandibular excursions.

The vertical dimension in static occlusion was not altered in any way, for cuspal points and occlusal sulci that maintained this dimension were not touched. Only planes which offered resistance to free excursion were reduced. Any cusps that were removed did not initially assist in

11. Hanau, R.: Instruction Books for Hanau, H 4, Articulator, Hanau Engineering Company, Buffalo, N. Y.

maintaining the vertical dimension. Missing teeth were replaced with suitable bridgework, either fixed or removable; the occlusal portion of tilted teeth was placed in contact with the opposing arch by means of gold inlays, and unsatisfactory fillings were replaced.

The object of this procedure in each case was to restore an occlusal plane fully equilibrated that permitted unhampered movements of the mandible in the various excursions and provided adequate support in all balancing and working positions.

Besides looking for occlusal disharmony in function as just described, all patients were carefully studied for possible overclosure or loss of intermaxillary distance by noting:

1. Appearance of the patient.

2. That occlusal relationship (vertical dimension) which allowed the maximum biting force to be registered, less the normal free way space. This relationship was found by gnathodynametric readings.[12]

3. Missing posterior teeth, which often pointed to a possible loss of this dimension.

4. Possible superior displacement of the condylar heads in the fossae as revealed by roentgenograms.

DIAGNOSTIC IMPORTANCE OF ROENTGEN EXAMINATION OF THE ARTICULATION

Roentgenograms made of the temporomandibular joint when it was in open and closed positions, following that concept of motion, were used in this project not only as a means of determining loss of intermaxillary distance but as a routine procedure in every case. The diagnostic importance of roentgenograms of the joint has been emphasized in this connection in a number of papers.[13] Riesner[14] has written:

> There is a need to determine the actual excursion of the condyle when the patient opens, as well as closes the mouth. Therefore roentgenograms must be taken in open and closed positions. Where indicated, the vertico-submental projection or cephalad-caudal projection should be taken to demonstrate the medial lateral displacement of the condyle head in the glenoid fossa, since medial lateral displacements cannot be determined readily in lateral projection.

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12. Kelly and Langheinz: Physiological Determination of the Vertical Dimension, Dent. Digest **49**:115 (March) 1943.

13. Riesner, S. E.: Temporomandibular Articulation: Its Consideration in Orthodontic Diagnosis, Internat. J. Orthodontia **22**:1 (Jan.) 1936. Gillis, R. R.: Roentgen Ray Study of Temporomandibular Articulation, J. Am. Dent. A. **22**:1321 (Aug.) 1935. Ernst, E. C., and Costen, J. B.: X-Ray Study in Relation to Mandibular Joint Syndrome, Radiology **30**:68 (Jan.) 1938. Higley, L. B.: Practical Application of New and Scientific Method of Producing Temporomandibular Roentgenograms, J. Am. Dent. A. **24**:222 (Feb.) 1937.

14. Riesner, S. E.: The Temporomandibular Joint: Its Roentgenographic Diagnosis and Clinical Importance, Arch. Clin. & Oral Path. **4**:26 (June) 1940.

Petrilli and Gurley,[15] however, reported that roentgenograms of the articulation were found unsatisfactory because of the superimposition of other structures, and Junemann [16] questioned their value and wrote

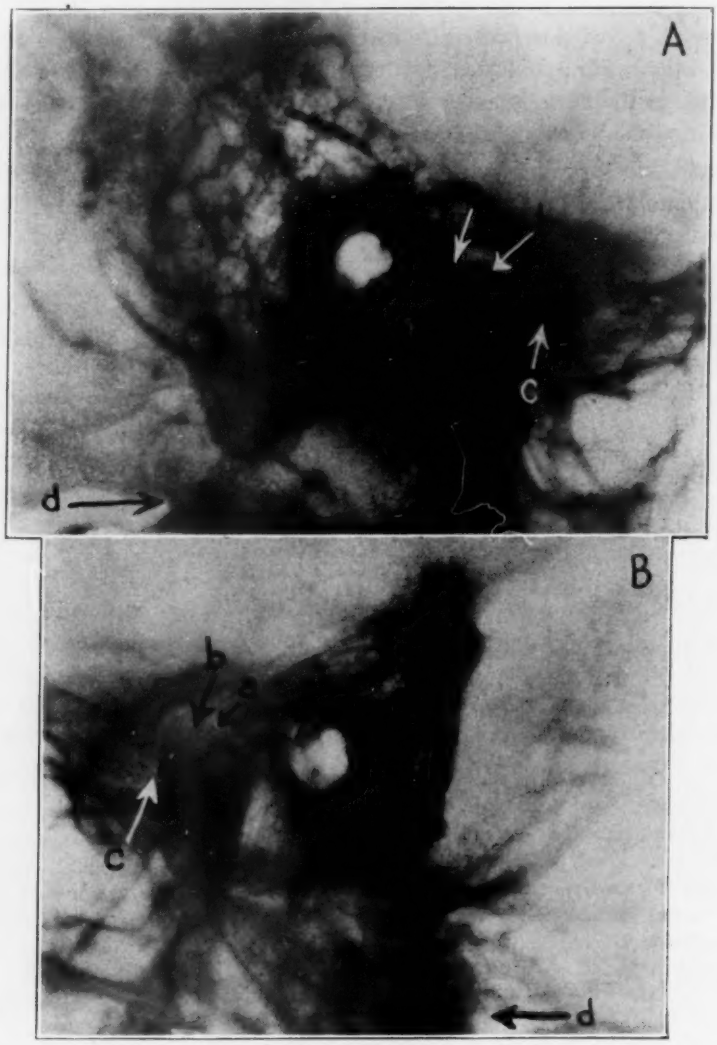

Fig. 1.—*A*, left temporomandibular joint, closed position, before treatment. Note the superior displacement of the condyle in the fossa. (*a*) Fossa. (*b*) Condyle. (*c*) Articular eminence. (*d*) Direction of movement.

B, right joint, closed position, before treatment. There is a superior displacement of the condyle.

15. Petrilli, A., and Gurley, J. E.: Topography of the Temporomandibular Joint, J. Am. Dent. A. **26**:218 (Feb.) 1934.

16. Junemann, H. R.: Consequences of Shortening Intermaxillary Distance, J. Am. Dent. A. **20**:1427 (Sept.) 1941.

"in none of the x-rays of abnormal cases was there any visible evidence of irregularities, bone destruction and any other abnormalities of any of the bony structures."

Our observations at the medical research laboratories of the submarine base at which this study was made have led us to believe that properly projected roentgenograms have great diagnostic value in the

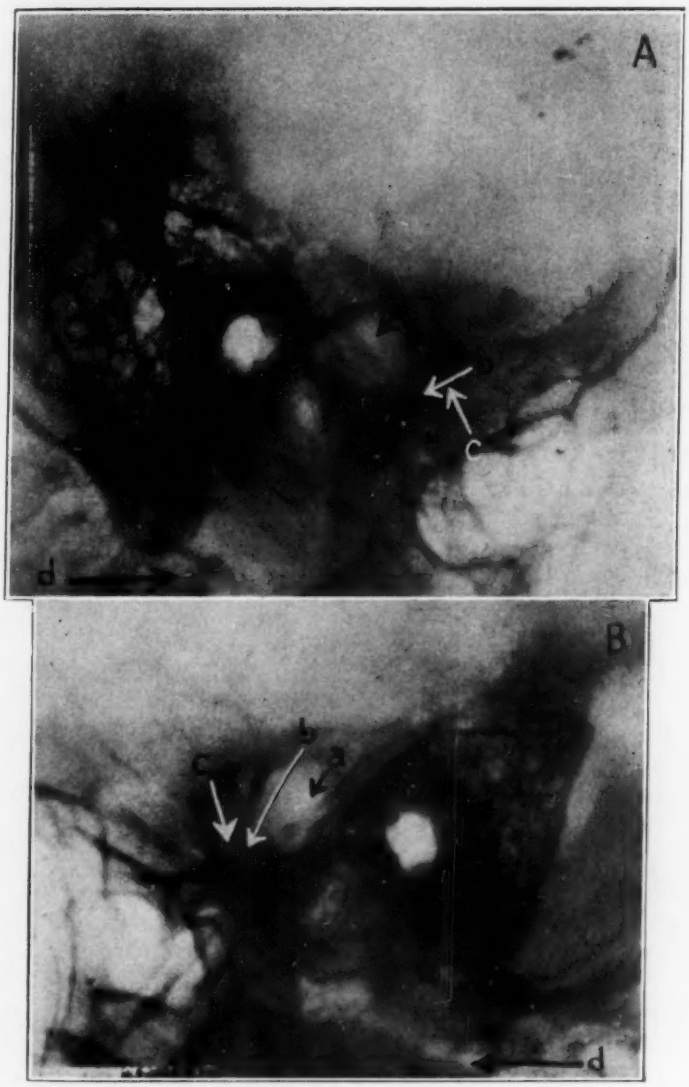

Fig. 2.—*A*, left temporomandibular joint, open position, before treatment. The condylar head becomes impacted against the mesial wall of the fossa, and a normal excursion is impossible. (*a*) Fossa. (*b*) Condyle. (*c*) Articular eminence. (*d*) Direction of movement.

B, right joint, open position, before insertion of the splint. The condylar head cannot leave the fossa and becomes impacted against the articular eminence.

analysis of Costen's syndrome, provided they are studied on a functional basis, as mentioned by Riesner, rather than as a means to determine morbid changes and alterations of contour of condyle and fossa.

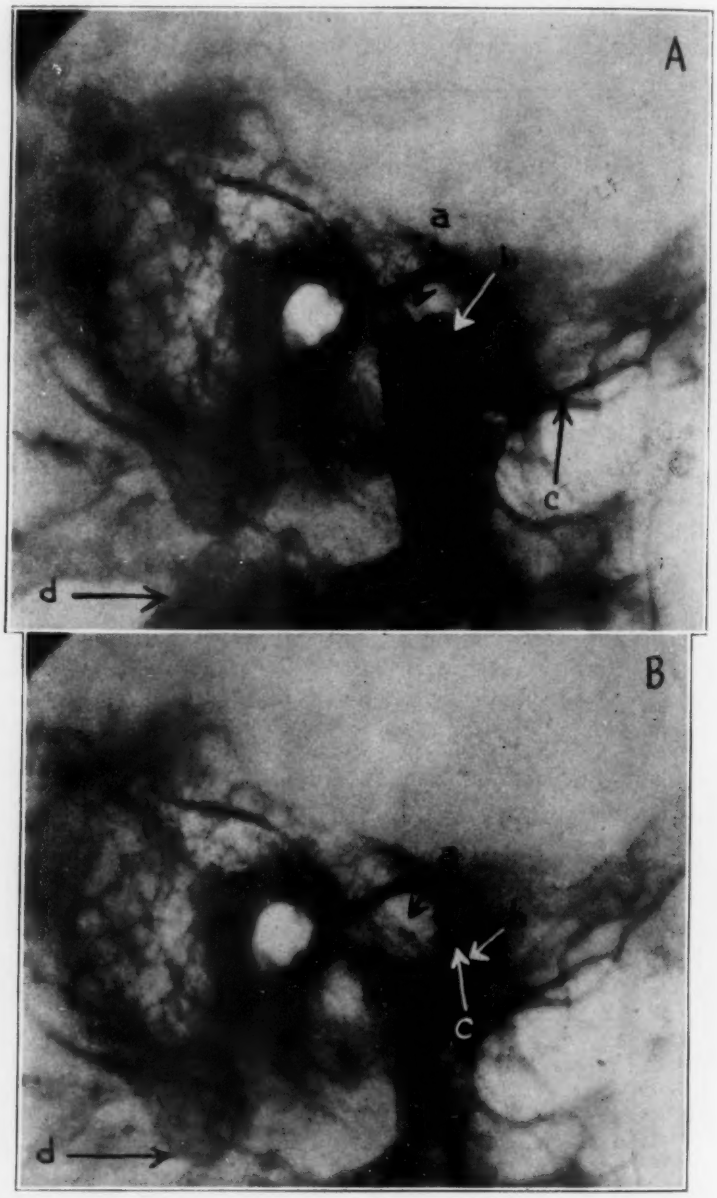

Fig. 3.—*A*, left temporomandibular joint, closed position, after the insertion of the splint. The condylar head is now in a more normal position. (*a*) Fossa. (*b*) Condyle. (*c*) Articular eminence. (*d*) Direction of movement.

B, left joint, open position, after the insertion of the splint. The condylar head is now out of the fossa and below the articular eminence.

Figures 1 through 4 illustrate the importance of roentgenograms in the diagnosis and the treatment of trismus (case 1).

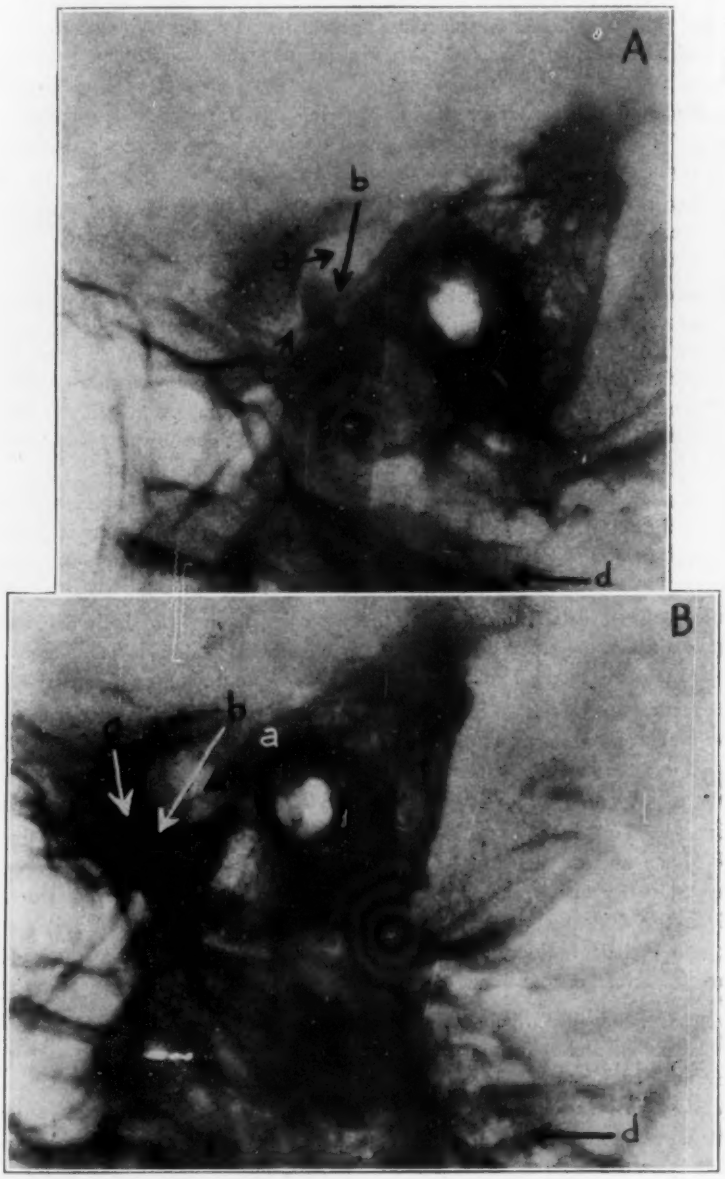

Fig 4.—*A*, right temporomandibular joint, closed position, after insertion of the splint. The condylar head is now in a more normal position. (*a*) Fossa. (*b*) Condyle. (*c*) Articular eminence. (*d*) Direction of movement.

B, right joint, open position, after the insertion of the splint. The condyle now leaves the fossa and is below the articular eminence.

TRISMUS: TREATMENT AND RESULTS IN ILLUSTRATIVE CASES

CASE 1.—O. R., aged 38, had noticed, for some years that the temporomandibular joint clicked on opening and closing. Recently he began to experience considerable pain and discomfort while chewing, and in the forty-eight hours prior to examination the pain was so exquisite that he was barely able to open his mouth. He stated that he suffered from headaches and that these had become progressively worse.

Examination disclosed that he was wearing a full upper and a partial lower denture. The upper denture had been inserted some three months previously, and he had experienced most of his discomfort since that date.

As shown in the roentgenograms (figs. 1 and 2), there is a superior anterior displacement of both condylar heads in the fossae in the closed position, and in the open position the condylar heads are unable to leave the fossae.

A mandibulomaxillary registration was obtained by having the patient close gently into soft heated wax until contact between two or more opposing teeth was made, but no further closure was permitted. The upper plate was then transferred to the Hanau articulator with the aid of a face bow. An impression of the lower jaw was made with the lower partial denture in position. A model was then run up from this impression by using a soluble plaster. The lower model was then mounted by using the wax registration previously obtained.

A study of the models in this position disclosed pronounced anterior premature contact and a flat occlusal plane out of harmony with the requirements of the fossae, which were steep. Overclosure of the mandible was determined from the roentgenograms as well as from the appearance of the patient.

Treatment consisted in removing the posterior teeth from both dentures and replacing them with a smooth acrylic plane (without teeth) which increased the intermaxillary distance 8 mm., and this plane was constructed on a steeper curve.

These dentures were then inserted and the patient's jaw immobilized with a Barton bandage. He was admitted to the dispensary and sedation prescribed. On the third day the bandage was removed, and he was encouraged to undertake some movements of ths jaws. Thus the principle of treating any sprain was utilized.

Figures 3 and 4 show the postoperative roentgenograms made with the jaws in both open and in the closed position. At the time these were taken he was discharged (after one week) symptom free. At the dental clinic teeth were again added to the dentures, the newly established plane being followed and during a six month period of observation there was no recurrence of either the headaches or the discomfort in and about the articulation while chewing.

CASES 2 and 3.—Both patients gave typical histories of clicking joints and recent pain, discomfort and limitation of movement associated with opening and closing. Models made and mounted in a relaxed centric relation revealed excessive premature contacts in various excursions and interfering inclined planes that caused the condylar heads to assume strained articular relations in the fossae. This was due to occlusal interference in function. Roentgenograms showed limitation of movement. Reduction of the inclined planes and removal of the premature contacts enabled the condyles to take unstrained positions in the glenoid fossae, and complete elimination of symptoms followed in a brief period. In these cases of trismus it is possible to have an objective as well as a subjective result.

OTALGIA AND OTHER NEURALGIAS ABOUT THE HEAD AND NECK: TREATMENT AND RESULTS IN EIGHTEEN CASES

For an estimation of the results of treatment of neuralgias we were forced to depend on subjective findings. In the 18 cases that fell into this category an improvement was noted in all, with complete elimination of symptoms in 14. In each instance the symptoms, though not too severe, were of long duration and failed to yield to other forms of therapy.

In every instance models mounted in an unstrained centric relation showed varying degrees of occlusal disharmony in function. Roentgenograms disclosed some limitation of movement, either unilateral or bilateral. Treatment consisted, in every case, of occlusal equilibration and the restoration of missing teeth with the objective of providing an occlusal plane that would permit unhampered excursions of the mandible. In no instance were splints to "open the bite" resorted to, and in this connection one of the cases is of considerable interest (case 11).

CASE 11.—M. V., a woman aged 23, gave a history of intermittent aural pain of some years' duration, most noticeable after eating and persisting for some hours. Accompanying this pain were stiffness and tenseness of the mandibular joint. Her ears had been thoroughly examined and found to be normal. The sinuses were normal, and the general physical condition was excellent. Prior to entering the Navy she had been referred to a dentist, and he suggested the construction of a splint to "open the bite." The height of this splint had been altered a number of times without helping the condition.

She was wearing the splint when first examined, and an inspection of the appliance disclosed that the cusp inclines on the splint were exerting excessive posterior leverage. Removal of the splint showed that the vertical dimension was normal and that with the splint in position this dimension was excessive and the jaw was overopened.

Roentgenograms of the articulation in open and closed positions revealed anterior displacement of the condylar heads, and an examination of models of the jaws in an unstrained centric relation showed marked premature contact of the incisor teeth. The labial inclined planes of the lower left central and lateral incisors and the lingual inclined planes on the upper left lateral and central incisors made the mandible swing 4 mm. to the left of the median line when full closure was done. This deviation was caused by the malposition of the two lower incisors.

Treatment consisted in reducing the inclined planes sufficiently to allow the mandible to assume an unstrained position and reestablish a normal median relationship when closed. During an observation period of four months the patient was symptom free.

TINNITUS: TREATMENT AND RESULTS IN SEVEN CASES

The symptoms in these 7 cases were (*a*) a stopping or a stuffy sensation of the ears, most noticeable about meal-time, (*b*) tinnitus, usually "buzzing" in type, and (*c*) occasionally a snapping noise while chewing. Two of the patients found that a normal volume of music on the radio

or in the movies was more than they could tolerate. One patient said "The sound seems to go right through me."

The tinnitus was unilateral except in 1 instance. Otoscopic examination of the patients with unilateral tinnitus showed retraction of the drum membrane in the affected ear, while in the unaffected ear the membrane was normal. Three patients were able to secure temporary relief by resorting to the Valsalva maneuver to ventilate the middle ear. The other 4 found this of no assistance.

It is generally agreed that tinnitus of this type is caused by stenosis of one or both eustachian tubes and that any treatment must have for its objective the restoration of involuntary (swallowing and yawning) and voluntary means of opening the tube and ventilating the middle ear.

The cause of stenosis of the eustachian tube has been attributed by Costen [9] to overclosure of the mandible causing compression of the pharyngeal portion of the tube. We cannot completely agree with this, as none of these patients had a demonstrable overclosure of the mandible.

From our experiments in working on aero-otitis media in submarine personnel, we believe that tubal blockage is caused by congestion of the lymphatics draining the tube and the middle ear, due in turn to restriction of muscle activity.[17]

Because our objective was the restoration of normal muscular activity, we again followed our concept of studying the jaws in motion. In the cases of unilateral tinnitus we found that in lateral excursion the interference was on the side away from the affected ear, while in the excursion on the side away from the unaffected ear there was no interference.

These 6 patients were treated by simply removing the lateral premature dental contacts, and all reported that they were symptom free, and they remained so over a period ranging from four to six months, after which further observations were impossible owing to their being transferred to other activities. In each instance the retracted drum membrane returned to normal.

The seventh case in this group was one of bilateral tinnitus. Clinical examination disclosed that there were excessive posterior contacts on the third molar teeth, with cuspal interference of the third molar teeth permitting little if any lateral movement in function, and that both drum membranes were retracted. The patient was treated by removal of the four third molar teeth. Shortly after their removal he stated that the "buzzing" in his ears had ceased and later reported that he was completely symptom free. He remained free of symptoms over an observable period of five months. Otoscopically, both drum membranes were no longer retracted.

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17. Kelly, W. J., and Langhienz, H. W.: Dental Therapy for the Prevention of Aero-Otitis Media, Ann. Otol., Rhin. & Laryng. **55**:13 (March) 1946.

GLOSSODYNIA: TREATMENT AND RESULTS IN TWO CASES

Two patients were seen in this series who complained of a burning sensation of the side of the tongue. Roentgen and clinical examination failed to reveal any unusual conditions other than some interference in lateral excursions. The occlusion in each case was as thoroughly equilibrated as the amount of tooth structure permitted, but no improvement in symptoms was obtained. They stated "that while their jaws felt more 'free,' the side of the tongue still burned." They were referred to the medical department for allergy studies but were transferred before additional information was obtained.

The only significant fact noted in these 2 cases was that roentgenograms taken in the verticosubmental projection with the mouth open failed to reveal any significant medial lateral displacement, so that possibly the chorda tympani was not impinged on.

DEAFNESS OR HEARING LOSS

Considerable unanimity appears to prevail throughout the literature concerning the importance of correcting mandibular position as an aid in the treatment of most of the symptoms of Costen's syndrome. This unanimity, however, changes to controversy when defects in auditory function are attributed to various changes within the temporomandibular joint.

Shapiro and Truex,[18] after a study of the literature and experiments of their own, expressed the opinion that erosion of the bony portions of the mandibular joint or of the articular disk, compression of the external auditory meatus by the mandibular condyle or any influence that the condyle may exert on the middle ear or the cochlea is a negligible factor in auditory impairment. They quoted Hill [19] who wrote:

> There is a sort of self hypnotism among deafened people, who, above all, desire to hear better, which causes them to feel improved temporarily under any new form of treatment. This imagined improvement plus the natural enthusiasm of the discoverer of the treatment sometimes leads to unwarranted claims for its efficacy, and it may have rather wide-spread use until careful observations of impartial investigators prove its ineffectiveness.

Our experiments so far tend to confirm the work of Shapiro and Truex. Preoperative and postoperative audiograms taken by the sound laboratory of the medical research department at this base have failed so far to disclose any change following these dental procedures.

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18. Shapiro, H. H., and Truex, R. C.: Temporomandibular Joint and Auditory Function, J. Am. Dent. A. **30**:1147 (Aug.) 1943.

19. Hill, F. T.: Changing Conception of Management of Chronic Progressive Deafness, Ann. Otol., Rhin. & Laryng. **51**:653 (Sept.) 1942.

CONCLUSIONS

1. Close cooperation between the dentist and the otolaryngologist is essential in the diagnosis and treatment of conditions that do not respond satisfactorily to routine therapies.

2. All temporomandibular articulations should be studied in motion, and roentgenograms should be taken with the joint in both open and closed positions. Models should be mounted on a suitable articulator.

3. Considerable caution must be exercised in the use of splints to increase the vertical dimension, lest additional strain be added to an already abnormal situation, and when used they should have an occlusal plane that is in harmony with the mechanical and physiologic requirements of the mandibular joint and should maintain a normal free way space to prevent trauma of the remaining teeth.

4. As malocclusion of the temporomandibular joint can result from malocclusion of the teeth, properly executed dental procedures appear to have a beneficial effect when the articulation goes into a zone of intolerance and the symptoms of Costen's syndrome are recognized.

5. A change in the relationship of the jaws does not appear to improve impaired hearing.

Captain C. W. Shilling (MC) U. S. N., Lieutenant Henry L. Haines (MC) U. S. N. R., medical research otologist, and Dr. Stacy R. Guild gave advice, valuable suggestions and assistance in the preparation of this paper.

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Clinical Notes; New Instruments and Technics

CORRECTION OF PROMINENT EARS

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Detroit

IN THE development of the external ear, if the cartilage does not attain the proper angulation in the region of the antihelix the ear protrudes. The correction consists essentially in reconstruction to obtain the proper angulation in the region of the antihelix. For social, economic and psychologic reasons, this is usually justified. However, as in all purely cosmetic procedures, the temperament of the subject should be taken into consideration, and unless it can be established that the deformity is a justifiable source of embarrassment and concern, correction should not be recommended. With small children the responsibility for the decision is divided between the parents and the surgeon. The best age for correction in children is thought to be at about the fifth year, or before they enter school.

Through the efforts of such pioneers in the field of plastic surgery as New and Erich,[1] Davis and Kitlowski,[2] MacCollum,[3] Luckett,[4] and others, a technic has been developed which is quite satisfactory in most cases. The technic described below, with some variation, follows that described by New and Erich.

When general anesthesia is used, nitrous oxide and ether administered by means of an intratracheal tube is the method of choice. If for any reason local anesthesia is preferred, the infiltration of 1 or 2 per cent procaine hydrochloride is satisfactory.

The surgical clean-up should include the inserting of an antiseptic-soaked strip of gauze into the external auditory canal. The operative field should be draped in such a way that both ears can be inspected simultaneously.

When the ear is bent toward the head, the desirable location for the antihelix becomes apparent (fig. 1 *A*). Since the cartilage is approached through the posterior surface of the ear, it is desirable to outline the location of the antihelix on the skin and the cartilage of the posterior surface while observing the anterior surface. This is best done by passing a hypodermic needle through the ear from before backward and, before it is withdrawn, touching its point with a cotton applicator that has been saturated with methylene blue (fig. 1 *B*). This will stain the skin and the cartilage sufficiently on the posterior aspect. To outline the antihelix properly it will be necessary to carry out this procedure at about six points (fig. 1 *C*).

1. New, G. B., and Erich, J. B.: Protruding Ears: A Method of Plastic Correction, Am. J. Surg. **48**:385-390 (May) 1940.

2. Davis, J. S., and Kitlowski, E. A.: Abnormal Prominence of the Ears: A Method of Readjustment, Surgery **2**:835-848 (Dec.) 1937.

3. MacCollum, D. W.: The Lop Ear, J. A. M. A. **110**:1427-1430 (April 30) 1938.

4. Luckett, W. H.: A New Operation for Prominent Ears Based on the Anatomical Deformity, Surg., Gynec. & Obst. **10**:635-637 (June) 1910.

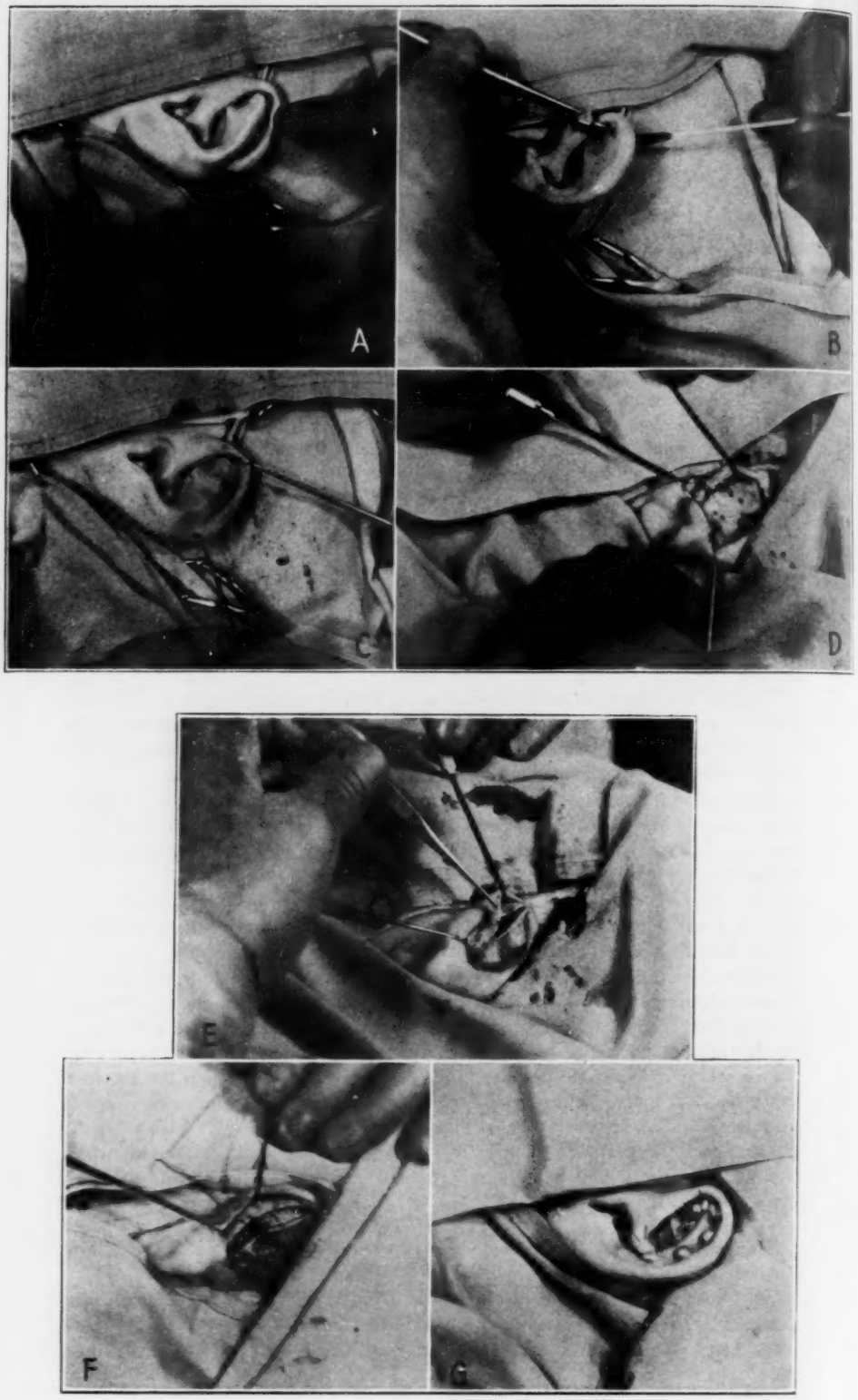

Fig. 1.—*A*, bending the ear back to determine the proper angulation of the antihelix. *B*, outlining the antihelix with a hypodermic needle and a methylene blue applicator. *C*, completion of the six-pointed outline of the antihelix. *D*, exposure of the stains on the cartilage by undermining the skin on both sides of an elliptic excision of the skin of the posterior surface of the auricle. *E*, removal of an elliptic strip of the cartilage. *F*, placing of mattress sutures by means of which the edges of the cartilage are to be approximated. *G*, preventing the cutting in of the skin by the suture silk, by means of small cotton rools.

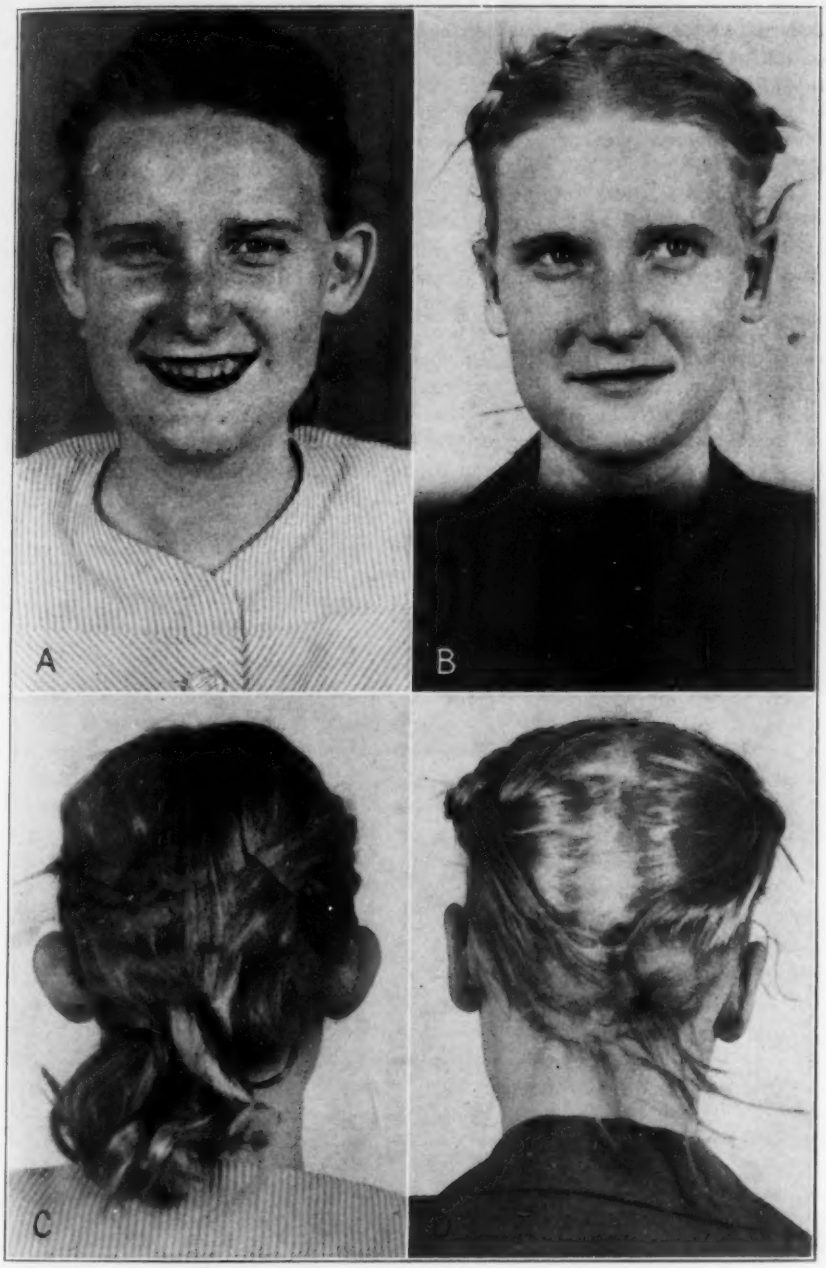

Fig. 2.—A patient whose outstanding ears were corrected by the procedure described. *A*, front view of ears before operation; *B*, after operation. *C*, back view of ears before operation; *D*, after operation.

Then, the outline being followed, an elliptic strip of the skin is excised from the posterior surface of the ear. Complete hemostasis is essential. The skin is undermined for a short distance on both sides of the incision so that the stains on the cartilage can be seen (fig. 1 *D*). A corresponding elliptic strip of cartilage should then be excised. This should not exceed 5 mm. in width, and care should be taken not to cut the skin of the anterior surface of the ear (fig. 1 *E*). The continuity of the remaining cartilage should be interrupted at each end of the ellipse. The edges of the cartilage are then brought together at an angle by means of about four mattress sutures of silk. The degree of the angle will determine the relative position of the ear to the head. Each mattress suture begins and ends on the anterior surface of the ear. It passes through both edges of the cartilages but not the skin on the posterior surface (fig. 1 *F*). "Cutting in" of the skin by the sutures is prevented by the use of small cotton rools (fig. 1 *G*). The posterior incision of skin is then closed with fine silk. If a typical lop ear is present, with drooping of the upper part, a similar procedure must also be carried out in the region of the posterior crus.

A pressure dressing should be kept on for about three weeks. The sutures are removed from the posterior incision on about the third postoperative day, and the mattress sutures are removed on the tenth or the twelfth postoperative day.

Figure 2 shows 1 of 8 patients on whom this procedure has been successfully carried out.

AN ACRYLIC OBTURATOR EMPLOYED IN THE REPAIR OF AN OBSTRUCTED FRONTONASAL DUCT

GORDON B. NEW, M.D., AND JOHN B. ERICH, M.D., ROCHESTER, MINN.

OTOLARYNGOLOGISTS have encountered fewer difficulties in preparing than in maintaining an artificially created passage from the frontal sinus to the nasal cavity in patients with an occluded infundibulum. Extranasal operations devised to create a frontonasal duct for adequate dependent drainage of the frontal sinus have become standard and reliable technics. But surgical procedures intended to prevent or to overcome the tendency toward partial or complete cicatricial stenosis of this newly constructed channel have been decidedly unsuccessful in a great many cases. Before making a plastic closure of an external fistula of the frontal sinus, it is essential that the frontonasal duct be open sufficiently to maintain drainage. If the sinus does not drain freely into the nose by a permanent channel, the fistula may recur. It was in making a frontonasal duct to secure drainage of the sinus that the present method was worked out. In a search for something to obviate this difficulty, we have found that an acrylic obturator (fig. 1), if properly constructed and if worn for a sufficient length of time, will avert stenosis.

As is well known, any cavity or tract artificially prepared in the body becomes quickly occluded by scar tissue unless it is held open by some mechanical means. After a time this tendency toward contracture gradually diminishes until finally the cavity will stay open without mechanical aid. In treating strictures of the larynx, the nostrils, the external auditory canals and other tubes, we have found that an obturator must be worn for approximately six months before the danger of contraction of the scar tissue in the walls of these structures has passed. Similarly, after external operations to reestablish the patency of a stenosed frontonasal duct, we have discovered that a corresponding length of time is necessary before an obturator can be removed from the duct without the prospect of subsequent cicatricial occlusion. The usual plan of mechanically maintaining the patency of the canal for a few days or weeks or even for three months, as described by Harmer and Hogg,[1] seems inadequate in the average case.

Obturators prepared to keep open a frontonasal duct have been constructed from different substances. Most surgeons employ either metal tubes or more frequently rubber tubing for this purpose. While obturators made of such materials do maintain patency of the duct, both types have disadvantages. Metal tubes are difficult to keep in position over a long period, while rubber tubing tends to elongate and change shape on exposure to the secretions in the nose. When a

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From the Section on Laryngology, Oral and Plastic Surgery, Mayo Clinic.

Read at the meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago, Oct. 15, 1946.

1. Harmer, W. D., and Hogg, J. C.: Operations on the Nose and Pharynx, in Turner, G. G.: Modern Operative Surgery, ed. 3, London, Cassell & Co., Ltd., 1943, vol. 2, pp. 1380-1437.

rubber tube has been displaced, it often is difficult to reinsert it into the frontonasal canal. Metal tubes do not inhibit the formation of granulation tissue in and around the duct, and rubber tubes actually stimulate the growth of granulations. Moreover, acting as a sort of irritating foreign body, metal and rubber tubes are likely to cause a discharge, often one with a foul odor. These, then, are among the difficulties encountered when the usual metal or rubber obturators are employed.

We have found, as was previously stated, that an obturator composed of one of the dental acrylic materials overcomes these difficulties (we use Vernonite, a methyl methacrylate resin). Such acrylic substances are employed by dentists in the preparation of artificial dentures. An acrylic obturator of proper contour has the following advantages: 1. It is worn without discomfort. 2. It never changes shape. 3. After being worn for two or three weeks, if it should become displaced

Fig. 1.—(*a*) Acrylic obturator employed to maintain the patency of an artificially created passage extending from the frontal sinus to the nasal cavity in a patient with an obstructed frontonasal duct. It is necessary to use such an obturator for about six months, at the end of which time there is no longer any tendency for this newly constructed channel to contract. (*b*) Obturator being held external to the nose to show the approximate position which the appliance would assume in the nasal cavity.

or is removed, it can easily be reinserted, even by the patient himself. 4. It is so smooth, nonporous and nonirritating that it inhibits the formation of granulation tissue. As a matter of fact, granulations which may be present at the time that the obturator is inserted quickly disappear. 5. The obturator produces no discharge and consequently no odor.

An acrylic obturator (fig. 1) for maintaining the patency of a surgically constructed frontonasal duct is prepared as follows: (We shall omit the details of the technic of constructing a passage from the frontal sinus to the nasal cavity in

patients with an occluded infundibulum except to say that an external approach to the frontal sinus is employed.) As soon as an adequate frontonasal canal has been established and while the cavity of the frontal sinus is still exposed through the external incision, a rubber tube of proper size is inserted through the nostril and through the newly prepared duct into the cavity of the frontal sinus. This piece of rubber tubing should be sufficiently long so that it protrudes out of the nostril for a short distance. It is held in position with adhesive tape.

After the inflammatory reaction of the operation has subsided, usually a period of about one week, a roentgenogram of the patient's skull is obtained; such a film (fig. 2) reveals the contour and the length of the rubber tube as it passes through the nasal cavity and the frontonasal duct into the frontal sinus. A sheet of pink

Fig. 2.—Roentgenogram showing a rubber tube passed into the reconstructed frontonasal duct. This type of roentgenogram is helpful in the construction of an acrylic obturator. See text.

dental base plate wax then is heated and rolled into a tubelike structure approximately the same size as the rubber tube in the patient's nose. While still warm, it can be molded to a contour simulating that which the rubber tube assumes in the nose as exhibited on the roentgenogram (fig. 2). The upper end of the wax obturator, which is to enter the frontal sinus, should be tapered slightly; the lower end, which will protrude through the nose externally, should be made to extend 2 or 3 cm. beyond the opening of the nostril.

We think that it is advisable at this stage to remove the rubber tube from the nasal cavity and insert the wax pattern through the nose into the frontal sinus. If it cannot be inserted with ease, its contour should be changed as required; such

alterations can be accomplished easily by warming the wax and molding it manually. After it is certain that the wax obturator is of proper size and shape, the rubber tube is reinserted into the nose, and the wax pattern is sent to a dental laboratory for processing in one of the dental acrylic materials. When the acrylic appliance is

Fig. 3.—(*a*) External fistula of the frontal sinus of long duration, secondary to osteomyelitis of the wall of the frontal sinus. Since the normal frontonasal duct was occluded, a new channel leading into the nose was created and held open for six months with an acrylic obturator. (*b*) External fistula closed. See figure 4.

ready, the rubber tube is removed from the patient's nose and is replaced by the obturator. That portion of the obturator which protrudes out of the nose can be cut off flush with the lower border of the nostril. Usually no fixation is required,

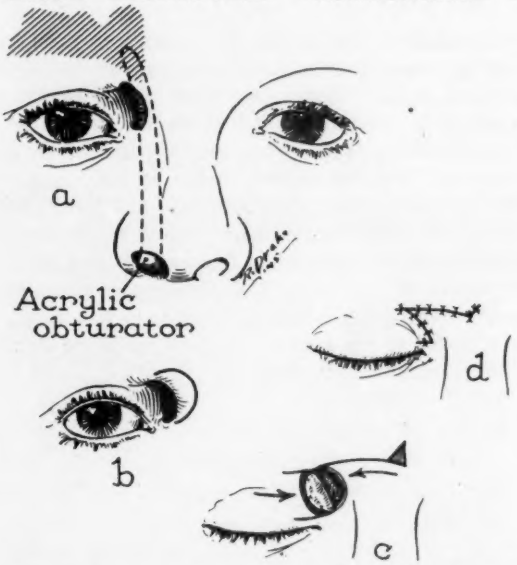

Fig. 4.—See figure 3 (*a*). (*a*) The dotted line indicates the position of an acrylic obturator in the right nasal cavity, the reconstructed frontonasal duct and the frontal sinus. (*b*) The first step in the plastic repair of an external fistula of the frontal sinus. A flap of skin adjacent to the defect is elevated and sutured back in position. This delay in transference of the cutaneous flap insures the latter's blood supply from the pedicle along the mesial aspect of the defect. (*c*) Two weeks later the pedicle flap of skin is reelevated, turned over and into the defect, and sutured in this position; this flap makes an epithelial covering on the frontal sinus side of the repaired fistula. A flap of skin (under the arrow) is elevated and slid across the defect to make an external epithelial covering. The triangular shaded area represents a fold of skin which must be excised to prevent buckling of the skin in this region. (*d*) Completed plastic repair of the fistula.

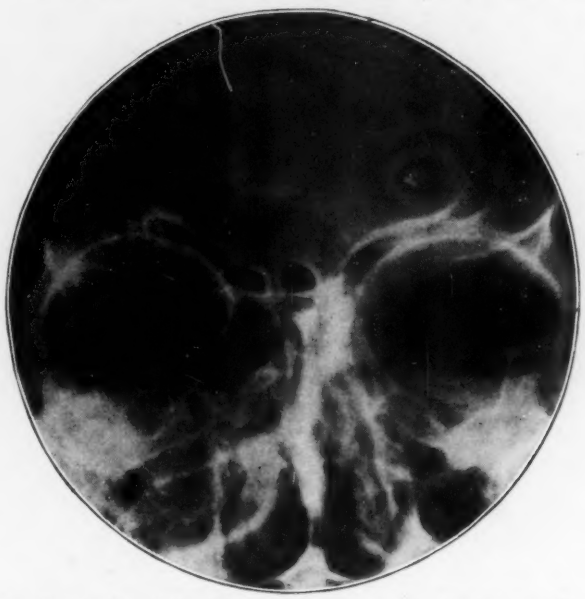

Fig. 5.—See figures 3 and 4. Six months later a roentgenogram shows a normal frontal sinus and a wide open frontonasal duct, into which a probe can be passed readily.

although a piece of adhesive tape across the nostril may be necessary in some instances. The obturator should not be made hollow, since a hollow obturator would permit nasal secretions to cake within; secretions of the frontal sinus work out easily around the obturator. Should an external fistula of the frontal sinus be present (fig. 3*a*), no attempt should be made to close the tract until the acrylic obturator can be permanently removed. Such an external fistula permits visual inspection of the upper end of the obturator, which should project into the frontal sinus cavity. Following removal of the obturator, a plastic closure of the fistula of the frontal sinus can be accomplished as illustrated in figures 3*b*, 4 and 5.

The obturator should be kept in position for approximately six months if the patency of the newly constructed frontonasal duct is to be assured. However, the obturator can be removed at any time as an office procedure should the physician wish to inspect the passage that it occupies.

OTOSCLEROSIS

An Index of the Literature, with Abstracts, for 1944-1945

THIS is the second installment of volume IV of "Otosclerosis," to be issued by the Central Bureau of Research of the American Otological Society, Inc.[1]

The lag in receipt of many foreign articles is beginning to lessen. Eventually we expect to print in these yearly installments articles unobtainable during the war, so that they may be placed in the volume IV loose leaf binder under their proper year.

The abstracts of the selected articles from the 1944-1945 literature are more extensive than in prior years. It is believed that for many readers this will be advantageous.

As in the past, the selection of articles implies no endorsement or condemnation. In all instances the opinions of the authors are quoted without comment. All titles are given in English and the names of all mediums of publication in the language of the original. Dr. Franz Altmann has continued to prepare the translations and outline the abstracts.

The installment for 1946 will be published in 1947, thus keeping volume IV up to date.

This installment, complete for the years 1944 and 1945, with title page and index of authors according to subjects, and properly perforated for binding in volume IV of "Otosclerosis," may be obtained at cost, $1.50, from

EDMUND P. FOWLER, M.D., *Editor.*

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1. The Central Bureau of Research, originally the Committee on Otosclerosis of the American Otological Society, Inc., is constituted as follows: Board of Trustees of the Research Fund: D. Harold Walker, M.D., chairman, Boston; John R. Page, M.D., vice chairman, New York; Edmund Prince Fowler, M.D., secretary, New York; Wesley C. Bowers, M.D., New York; Marvin F. Jones, M.D., New York; J. Gordon Wilson, M.D., Chicago; D. E. Staunton Wishart, M.D., Toronto, Canada. Lay Advisors to the Board: Sterling W. Childs, honorary chairman, New York; George E. Coleman, Santa Barbara, Calif.; E. Ericson, New York; Samuel Lloyd, New York. Consultants to the Board: Madison Bentley, Ph.D., Sage professor of psychology, Cornell University; J. B. Collip, M.D., D.Sc., F.R.C.P., F.R.S., professor of biochemistry, McGill University; Stacy R. Guild, Ph.D., Baltimore; Oscar Riddle, Ph.D., department of genetics, Carnegie Institution of Washington. Treasurer: Walter C. Baker. Depositary: Guaranty Trust Company of New York. Office of the Secretary: 140 East Fifty-Fourth Street, New York.

INDEX OF LITERATURE WITH ABSTRACTS

Altmann, F. New Contributions on the So-Called Otosclerosis of Chickens, *Arch. Otolaryng.* **39:** 59 (Jan.) 1944.

The author's summary is as follows:

In the labyrinthine capsules of various types of adult wild birds, some living in their natural habitat and some in captivity, there was little evidence of internal reconstruction. Quails and pheasants kept in captivity up to nine months on a diet which was poor in calcium and rich in phosphorus showed generalized osteodystrophia fibrosa of the skeleton with certain histologic similarities to von Recklinghausen's type (so-called "low calcium rickets"). The parathyroid glands were markedly enlarged. The changes in the labyrinthine capsules of wild birds were identical with those frequently found in the chicken capsule. Such changes have been interpreted in various ways by different authors. The changes were identical with those described by Wittmaack in the chicken capsule and regarded by him as experimentally produced.

The changes apparently represent a manifestation in the labyrinthine capsule of a generalized disease of the skeleton most probably caused by faulty nutrition. In spite of their histologic similarity to, or even identity with, certain stages of human otosclerosis, as far as is now known they have nothing to do with true otosclerosis.

Bustamente Gurria, A., and Garibay Fernandez, A. Otosclerosis, *Prensa méd. mex.* **9:** 171 (Dec. 15) 1944.

This is a general review of the problem, including the pathologic anatomy, the etiologic factors, the symptoms, the diagnosis, the prognosis and the treatment of the disease.

Otosclerosis in Pregnancy. Editorial, *New York State J. Med.* **45:** 2643 (Dec. 15) 1945.

Progressive deafness in women is frequently assumed by both physicians and the laity to present an adequate reason for an interruption of intercurrent pregnancy, mainly because of its assumed effect on the patient and the possibility that the affliction may be transmitted to the offspring.

Little is known about this disease, as a matter of fact. A mere hereditary factor does not explain the pathologic process by which spongy bone is deposited in the area of the ossicles and the oval window. Certain German observers have assigned the process to a definite Mendelian mechanism; others deny that such conclusions are valid. It is not possible to prophesy from available clinical evidence whether the progeny will be afflicted or whether eugenic measures will stamp out the disease, as some have claimed.

In view of the uncertainties, one must welcome the conservative attitude expressed in two recent articles, one by an obstetrician,[2] the other by an otologist.[3] The physician in general practice, as well as the

2. Allen, E.: Pregnancy and Osteosclerosis, Am. J. Obst. & Gynec. **49**:32 (Jan.) 1945.

3. Barton, R. T.: Influence of Pregnancy on Otosclerosis, New England J. Med. **233**:433 (Oct. 11) 1945.

specialist, should not be too ready to advise abortion in such cases. Too little is known about the cause of the disease to warrant radical measures.

Allen, E. D. Pregnancy and Otosclerosis, *Am. J. Obst. & Gynec.* **49:** 32 (Jan.) 1945.

Otosclerosis should probably not contraindicate marriage or a trial pregnancy. Otosclerosis in the primipara should not be considered as an indication for therapeutic abortion. In the multipara it might be an indication, provided that accurate otologic evidence obtained in previous pregnancies has shown a definite and sustained loss of hearing.

Before therapeutic abortion is decided on, the patient should be informed that otosclerosis is a progressive disease even without pregnancy; also, that a hearing aid and lip reading offer great help.

Barton, R. T. The Influence of Pregnancy on Otosclerosis, *New England J. Med.* **233:** 433 (Oct. 11) 1945.

Among 114 women suffering from otosclerosis the hearing deteriorated in at least one pregnancy in 64 per cent. In 20 per cent the deterioration started during pregnancy, in 50 per cent immediately following it and in 30 per cent six months or more after parturition. It is during the first pregnancy that the hearing is most likely to be affected. (In 72 per cent of the women the hearing was affected at the first pregnancy.) The patient, however, has a 50 per cent chance of not experiencing further progression of otosclerosis in subsequent pregnancies.

Abortion is never justified in the management of otosclerosis, for four reasons: First, the effect of pregnancy on otosclerosis is extremely variable and unpredictable; there is no exact relation between the two conditions, and the effect of previous pregnancies is not an accurate index of the effect of subsequent ones. Second, the favorable effect of abortion on otosclerosis is also inconstant. Third, the disease does not endanger the life of the mother as do the accepted indications for therapeutic abortion. Fourth, this type of deafness is not the severe handicap that it once was, owing to the advent of the modern hearing aid and the promise of successful surgical treatment.

Sterilization or other eugenic measures are futile in the control of otosclerosis, because the hereditary nature of the disease is not known accurately and it is impossible to prophesy deafness of progeny, and because, as stated, the unfavorable effect of pregnancy on otosclerosis is not constant.

The final decision concerning the role of abortion and of sterilization in otosclerosis must await complete etiologic understanding of the disease.

Day, K. M. Evaluation of the Fenestration Operation for Otosclerosis, *Pennsylvania M. J.* 48: 684 (April) 1945.

Fenestration has proved successful in restoring and maintaining practical hearing for "normal" conversation in a high percentage of the persons operated on. Between 1941 and 1944, 54 patients were operated on, and practical hearing was restored in 40 of them; in 3 the fenestra closed but was successfully revised. Altogether, there were 43 successes—80 per cent. Only a small percentage of persons—about 10 per cent—with hearing affected by otosclerosis are suitable candidates for this operation because of secondary degeneration of the acoustic nerve. The operation should be restricted mainly to people between the second and fourth decades of life. The hearing for bone conduction should not drop more than 20 to 25 decibels at any point in the speech range—to make the operation a good gamble for the patient.

Unless a successful technical result can be expected to give good practical hearing for "normal" conversation, the operation is contraindicated and a hearing aid should be prescribed. If, however, hearing for normal speech can be achieved by fenestration, it is far superior to the distorted hearing obtained with a hearing aid.

The operation should be reported as successful only in those cases in which the hearing reaches the level of practical conversational hearing, which is somewhere around the 25 decibel level in the speech range. In all the other cases the operation should not be regarded as a success no matter how great the decibel gain was in the individual frequencies.

De Gunten, P. Experimental Changes of the Labyrinthine Capsule Produced by Dihydrotachysterol, *Pract. oto-rhino-laryng.* 4: 196, 1942.

A 5 per cent solution of dihydrotachysterol in oil (A. T. 10) injected into mice produced diffuse changes of the whole skeleton, including all the three layers of the labyrinthine capsule. The changes were characterized by osteoclasia with fibrosis of the marrow and the absence of any new formation of bone. This experimentally produced osteodystrophia fibrosa differs from otosclerosis not only in its morphologic appearance but also in the sites of its localization.

The author believes that otosclerosis is caused by a general metabolic disturbance, but he does not think that there is any proof of a parathyrogenic origin of the disease. Under these circumstances the treatment of otosclerosis with the aforementioned preparation is not justified.

Demetriades, T., and Patelis. Extensive Spinal Tap for Treatment of Otosclerosis, *Zentralbl. f. Hals-, Nasen- u. Ohrenh.* 33: 624, 1940.

Following the method of treatment inaugurated by Max Meyer, the authors combined an extensive spinal tap and removal of 40 to

50 cc. of cerebrospinal fluid with intravenous injections of 200 cc. of a 5 per cent hypertonic solution of sodium chloride. In several cases of otosclerosis the tinnitus was considerably lessened in intensity; the hearing was less markedly affected.

Fowler, E. P. Prevention and Alleviation of Progressive Deafness, *Laryngoscope* **54:** 209 (May) 1944.

The author holds that "progressive deafness" is an inadequate diagnostic term "because progressive deafness may be due to almost any of the disorders and diseases directly or indirectly attacking the ear if they are sufficiently severe, recurrent or prolonged." His criterion for progressiveness consists in finding on successive dates over a long period threshold audiograms totaling a permanent loss of 10 decibels or more at two or more frequencies, whether or not some of the other frequencies temporarily show no change. Other criteria for determining the progressiveness of deafness are set forth.

Fowler believes that the audiogram does not necessarily correspond to the hearing of speech, because in the understanding of speech many factors are involved besides the mere ability to sense a single frequency or any group of frequencies.

Some one will say: "It does not matter what the audiogram shows; it is how one hears actual speech that matters." That is true in a way; nevertheless, the only accurate measure of capacity to hear is an audiometric measurement at the different frequencies. Discrete tones are the simplest sounds for testing the hearing capacity. Note that it is "capacity to hear" which is measured, not the "ability to interpret" or "the incentive or willingness or desire to understand" speech, whether or not such capacity is used, or however it is used. If not used, it is still available for the patient to call on whenever he needs it and uses sufficient concentration and practice to make the most of it.

Otosclerosis is the condition usually thought of as synonymous with progressive deafness, but in otosclerosis the cause of the progressive deafness is ankylosis, which occurs in less than 12 per cent of the people harboring otosclerosis, and continuous progressive deafness occurs in even a smaller percentage of people.

Deafness due to deterioration of the acoustic nerve, particularly that in old age, is sometimes thought of as synonymous with progressive deafness. This also is not necessarily true except in a long term sense.

The term "progressive deafness" designating an entity should be abandoned unless it is qualified by a statement of one or more of the underlying causes.

Many of the causes of progressive deafness are discussed and reasons given for the neglect of treatment, the major one being that there may be sufficient hearing in the ear to get along with, especially if there is a better ear on the opposite side of the head.

The author's philosophy of treating and managing both suppurative and nonsuppurative diseases of the ear from the standpoint of prevention of deafness is set forth. Two of the items are especially important:

1. Do not delay operating after deciding that there is danger of prolonged suppuration, especially if there have been prior or recurrent suppurations of the middle ear and the mastoid bone.
2. If there is any question of a delayed resolution, reestablish and maintain adequate drainage by manipulative or operative procedures.

The importance of the properly timed and executed simple or modified radical mastoidectomy and of irradiation to remove hypertrophied lymphoid tissue from the nasopharynx is discussed from the standpoint of preventive treatment; also means of testing the function of the eustachian tube are described, together with the treatment of the occluding lymphoid tissue or mucus.

Regarding the fistulization of the labyrinth, the author mentions the acrimonious and emotional controversies and whisperings and the lack of confidence regarding the reported statistics. He believes that some progress is being made and that experimentation should be continued. However, the patient should be fully informed before operation as to the chances of improvement, the risks involved and the postoperative reactions.

Tinnitus is often neglected as a warning signal of impending or progressing deafness. It can be controlled in many instances.

There are indications that otologists are on the threshold of epoch-making accomplishments for the relief of deafness. But no matter what such corrective measures may accomplish, successful prevention of deafness with steps being taken before rather than after the advent will accomplish more for the patient. It is usually difficult to institute and enforce preventive measures, but this should be the ideal and the goal. Not for one moment should otologists allow themselves to neglect preventive treatment or such alleviating measures as hearing aids, psychologic, social and employment rehabilitation. The societies for the hard of hearing have taught otologists much along these lines. The cooperation of all otologists in this work is needed if they are to increase the liberties and the pursuit of happiness of those who are threatened with lowered hearing.

Fowler, E. P. Early Diagnosis and Arrest of Otosclerosis: Clinical and Histologic Otosclerosis, *Arch. Otolaryng.* **42:** 253 (Oct.) 1945.

"Today otologists know no way to diagnose early (subclinical) otosclerosis, no sure way to diagnose early or late ankylosis of the stapedial footplate (clinical otosclerosis) and no way of curing the lesion. They possess little knowledge of possible means of arresting it and have no means of preventing its inheritance. . . . In the absence of deafness diagnosis has been impossible." Ankylosis of the stapes

never begins in the annular ligament or the round window membrane, and, like the deafness, it occurs late in otosclerosis and often simulates "other lesions that produce impedance."

Unfortunately, therefore, when the otologist first sees the patient the lesion is in the late stage. The variations in the hearing pattern are shown in audiogram charts, not one of which is necessarily indicative of otosclerosis.

The author discusses several possibilities in diagnosis along these lines, and also diagnostic signs other than auditory. Severe deafness from otosclerosis can often be differentiated from a like amount of deafness from nerve lesions only by the absence of the author's "recruitment" of loudness phenomena.

Histopathology has furnished data as to the variations of incidence according to age, sex and race, but no clue as to causes.

Otosclerosis occurs with or without a family history of the disease and in all states of health, frequently in the healthiest. In the white race about one third of the patients have multiple and one third unilateral lesions. None of the nonauditory signs are pathognomonic, and several may even be only suggestive of impending otosclerosis in the absence of deafness. Like the auditory signs, all may be absent in the presence, and all may be present in the absence, of otosclerosis. However, they should not be ignored.

The author does not believe that menstruation affects the hearing of a patient with otosclerosis any differently than it does that of patients with other impedance lesions of similar pattern and degree.

In the present state of knowledge it is not the otosclerosis per se which is most important, it is the activity of the lesion and the ankylosis. Without recurrent or sustained activity of the lesion there is no ankylosis, and without ankylosis there is no deafness.

Guild's material is discussed in minutiae. It indicates that there are over 10,000,000 people in the United States with otosclerosis and that over 1,000,000 of them are suffering from deafness (ankylosis) due to that condition. At death one half of the white males and females had no active lesion, which may be interpreted as indicating that sex alone is not a major factor in the incidence of activity and therefore not a major etiologic factor in spite of the fact that twice as many females as males harbor the lesion. The incidence of inactivity and activity in different periods of life in the two sexes is stressed, and other implications of the data are discussed. Early detection of ankylosis is imperative for successful arrestive treatment. In Guild's material there was no ankylosis of the stapes in any one who died before the age of 44 years. The incidence of activity of the ankylosis and even of the otosclerosis itself may be greater (or vice versa) in well people generally than in the material studied by Guild, which came from sick people who died.

It is important to compare the two ears with each other instead of just with the average normal ear to detect beginning otosclerotic changes, as one ear always precedes and differs somewhat from its fellow in its early symptoms and early lesions. At intensities above threshold the changes in quality are often sensed nearer threshold in ears affected by otosclerosis than in ears without otosclerosis. All of these and other differences have been observed and are worth further study.

The claim that the fistula operation arrests otosclerosis is denied.

A simple plan for early detection, guidance and treatment is outlined. The necessity of comprehensive examinations beginning just before puberty and including medical and laboratory observations, even if the children in otosclerotic families show no deafness, is advocated.

Above all, the patient should not be neglected.

Fowler, E. P.: Head Noises in Normal and Disordered Ears: Significance, Measurement, Differentiation and Treatment, *Arch. Otolaryng.* **39:** 498-503 (June) 1944.

Tinnitus should not be considered only as a symptom of disease of the ear. It is a symptom frequently found associated with disorders of other parts of the body. The therapy has been unsatisfactory, largely because attention has been focused too much on the symptom and not enough on its cause and its exact place of origin. The author classifies head noises basically into two kinds: (1) vibratory and (2) nonvibratory. These may operate singly or in combination, and be transient, recurrent, intermittent or constant.

Vibratory noises are real sounds, mechanical in origin, arising within, or brought to, the ear through the various mediums of the body. Nonvibratory tinnitus is caused by biochemical irritations of the auditory neural mechanism. It is an illusion of sound but not an irritation.

The author discusses the various types of vibratory and nonvibratory tinnitus and their differentiation and close association with certain disorders, particularly otosclerosis and other forms of obstructive deafness, and nerve deafness.

Tinnitus may be caused by irritation anywhere along the auditory neural tracts and directly or indirectly through the autonomic system in the same way that irritation anywhere along the course of the ocular or any sensory nerve tracts can cause a sensation. No tinnitus has been observed through animal experimentation, and research should be carried out along these lines.

The causation of nonvibratory tinnitus is discussed. Edema and lack of oxygen in the tissues, causing impending or actual degeneration of the neural elements, and local or general anoxia are often the cause of tinnitus, and one can take steps to alleviate or prevent it and the psychosomatic disorders accompanying and influencing it.

The author discusses the masking and measuring of tinnitus and describes the methods of accomplishing this. He is of the opinion that a nonvibratory tinnitus that is difficult to mask is caused by irritation in the neural mechanism central to the cochlea. Management and treatment are discussed at length, particularly the emotional factors involved.

Guild, S. R. Histologic Otosclerosis, *Ann. Otol., Rhin. & Laryng.* **53:** 246 (June) 1944.

The temporal bones of 1,161 patients (586 white persons and 576 Negroes) were examined in serial sections. The incidence of histologic otosclerosis in patients 5 years of age or older is 1 in 12 persons for the white and 1 in 96 for the Negroes. For white males the incidence was 1 in 8; for the females, 1 in 15.

As to the Negroes, the number with otosclerosis is too small to warrant conclusions with respect to a sex difference in the incidence. The 81 ears which were found to be affected with otosclerosis had a total of 113 otosclerotic areas, of which 65 were located anterior to the oval window and 125 near the round window. Ten of the areas were limited to the footplate of the stapes and appeared to have originated in that structure. Stapedial ankylosis had occurred in only 10 of the 81 otosclerotic ears. In 45 ears an otosclerotic area was less than 0.1 mm. from the stapedial footplate, but ankylosis had not occurred from this source, and there was no mechanical interference with the transmission of sound waves. No reason is known why one otosclerotic area stops short of ankylosis of the stapes and another area similar in appearance spreads across the annular ligament to the stapedial footplate.

In 46 cases both temporal bones were sectioned; in 32 of them the otosclerosis was bilateral, in 14 unilateral. It is evident that unilateral otosclerosis is not a rarity. It occurred in almost one third of the cases examined.

Atrophy of the cochlear nerve fibers or of the organ of Corti was not observed more often in ears with otosclerotic areas than in ears free from otosclerosis. When atrophy did occur in otosclerotic ears, it was usually limited to the basal turn and differed in no way from the atrophy of nerve and end organ that is seen in the sections of ears without otosclerosis. It therefore does not seem logical to attribute to otosclerosis much if any of the atrophy of the cochlear nerve found in otosclerotic ears.

A clear distinction must be made, in all discussions of otosclerosis, between clinical otosclerosis and histologic otosclerosis. The disease is often asymptomatic and does not cause impairment of hearing unless ankylosis of the stapes occurs. For that reason it remains unrecognized in the great majority of cases, and the otologist should attach little importance to a negative family history of deafness, even when this is

well authenticated. The histologic facts render invalid all conclusions respecting dominant and recessive genes that have been drawn from clinical studies of the inheritance of otosclerosis. To obtain a sufficient basis for a reliable determination of the hereditary factors of otosclerosis it would be necessary to examine histologically the temporal bones of all members of many family groups, irrespective of their acuity of hearing. Only thus can the presence or the absence of the primary disease, histologic otosclerosis, be determined.

Hall, I. S. Surgical Treatment of Otosclerosis, *Proc. Roy. Soc. Med.* **37:** *737* (Oct.) 1944.

The author reviews the question of surgical treatment of otosclerosis from the experience gained in 66 operations. He now operates with the patient under light ether anesthesia following heavy preoperative medication. A one stage technic with a retroauricular incision is employed. After the cells of the mastoid process have been cleaned out and the attic has been opened, the flap is created from the drum and the adjoining parts of the posterosuperior portion of the skin of the external canal. Then the incus and the head of the malleus are removed, and the fistula is made over the ampulla of the lateral semicircular canal with burrs, scrapers and other instruments. The flap is held in position over the fistula with paraffin packs, and the retroauricular incision is completely closed. After ten days a cutaneous graft is inserted into the wound cavity.

If an improvement of hearing is maintained for more than four months after operation, it is likely to persist for some time. Of the author's early operations, 36 per cent have resulted in an improvement of hearing that was retained; of his more recent operations, 66 per cent. Deterioration of hearing following operation must be judged not only by the decibels lost from the original postoperative gain but by the probable loss of hearing had no operation been performed. That is to say, that although the average immediate gain of 25 to 30 decibels was found as a rule to have sunk to a permanent level of 10 to 15 decibels after two or more years, the real gain of the patient is this 10 to 15 decibels plus the amount of deterioration in the opposite ear.

Only 1 patient died—six hours after the operation, evidently from idiosyncrasy to morphine.

Postoperative infection of the middle ear proved harmless, but infection of the operative cavity, unless checked at once, is almost certain to ruin any chance of improvement of hearing.

Two patients became pregnant after the operation. In one the hearing deteriorated to some extent; in the other it remained stationary.

There are common characteristics of the patients showing improvement. The majority are young, usually under 30. The deafness is not extreme; there is neither sign nor history of disease of the middle

ear, and there is no nerve deafness. The patient must be intelligent enough to reeducate himself to the use of the regained hearing.

Hall, I. S. Fenestration of the Labyrinth, *J. Laryng. & Otol.* **60**: 200 (May) 1945.

The author uses a Reichert dissecting microscope when making the fistula and an irrigation apparatus. The patient gets heavy premedication followed by light etherization.

The postauricular approach is employed and the cells of the mastoid process cleaned out to such an extent only as to gain proper access to the middle ear. The fistula is made over the ampulla of the lateral canal, and the tympanomeatal flap is kept in place by paraffin packs. The first dressing is done on the fifth to seventh day, followed one day later by grafting of skin in the cavity (in the majority of cases). No purulent labyrinthitis or facial paralysis occurred. Otitis media developed in 3 cases. There were 2 deaths, 1 from morphine idiosyncrasy and 1 from acute cardiac failure.

Improvements of hearing lasting from five months to several years were achieved in 54.9 per cent of the cases. It varied in individual cases from 5 to 30 decibels over the speech range of frequencies. In a favorable case 25 to 30 decibels may be expected at the optimum period. This is usually immediately after the ear has completely healed, and it may last for weeks or months. After an interval of eighteen to twenty-four months the acuity diminishes in most cases, until a permanent level of 15 to 20 decibels of gain is reached.

Revisions were made in 3 cases and were technically difficult because the membranous canal adhered to the scar tissue in the fistula.

Four patients became pregnant after operation. In 1 of them there was marked deterioration of hearing; in 3 there was no change. Selection of patients is essential, although sometimes brilliant results are obtained in apparently unfavorable cases. Contraindications are previous disease of the middle ear and marked inner ear deafness. The best results are obtained in patients younger than 30 years; the prognosis gets worse with increasing age. Sinusitis and nasopharyngeal disease are also contraindications.

Operations after which, in spite of an open fistula, the hearing has not improved should not necessarily be regarded as complete failures, for though further deterioration of hearing occurs in the contralateral ear it does not occur in the ear which has been operated on.

Henschke, E. Osteopsathyrosis and Otosclerosis, *Acta oto-laryng. orient.* **1**: 67, 1945.

A man of 37 years complained of increasing deafness without dizziness. There was a combination of blue scleras, osteopsathyrosis and otosclerosis—a syndrome described by van der Hoeve and de Kleyn in 1918. There had been 4 or 5 fractures without preceding trauma.

The disease seems to be due to some deficiency in the number and in the function of the osteoblasts. A table is set down showing the heredity as observed in grandparents and siblings.

House, H. P. What Can Be Done for the Deafened Today? *California & West. Med.* **63**: 130 (Sept.) 1945.

The paper briefly reviews the etiologic factors, the diagnosis and the methods of treatment of the various types of deafness.

Otosclerosis accounts for 65 per cent of all deafness in this country. Any progressive bilateral impairment of hearing occurring in early or middle adult life, which on examination is not associated with evidence of aural disease, strongly suggests otosclerosis. This coupled with coexistent tinnitus and a family history of deafness is almost diagnostic of otosclerosis. The fenestration operation is the only treatment for otosclerosis. It achieves permanent "practical hearing" in about 65 per cent of the cases.

The nerve function of the ear successfully operated on seems to remain at its preoperative level instead of gradually deteriorating, as does that of the ear not operated on. This has not been satisfactorily explained, for it is obvious that the surgical procedure in no way influences the otosclerosis but merely shortcircuits the involved area so far as the hearing mechanism is concerned. It is thought that the progressive nerve loss may be on the basis of atrophy due to disuse. Today the patient with otosclerosis has but one of two choices when the loss of hearing becomes pronounced. One is the hearing aid and the other is the fenestration operation. The hearing aid, within its limitations, will give satisfactory results in the early stages of otosclerosis. Ultimately, if the patient lives long enough and if the otosclerotic process advances to involve the nerve beyond the conversational range, even the hearing aid is of little or no value, and the patient must turn to rehabilitation and lip reading, just as in the case of far advanced nerve deafness.

Jent, R. The Surgical Treatment of Otosclerosis, *Pract. oto-rhino-laryng.* **7**: 275, 1945.

Jent reports 1 case in which he used a modification of Lempert's method. Eight weeks after the operation, "practical hearing had been restored, and the tinnitus disappeared. Dizziness was present before the operation but disappeared four days after the operation. The author believes that in otosclerosis the intralabyrinthine pressure is increased owing to anomalies which have occurred in the circulation of the blood in the labyrinthine capsule and in the stria vascularis. He explains the effect of the operation as a restoration of the normal perilymphatic and endolymphatic pressures.

In the discussion following this demonstration Ruedi criticizes the preoperative and the postoperative functional examination as incorrect

and incomplete and doubts Jent's claim that the hearing was phenomenally improved one day after the operation in spite of the bandage.

Nager stresses the tendency of the fistula to undergo bony closure. The uncertainty of the permanent results has so far prevented Nager from seriously recommending the operation to his patients.

Jones, M. F. Surgical Treatment of Impaired Hearing: The Results Obtained by Using the Lempert Endaural Fenestration Technic, *Tr. Am. Acad. Ophth.* **48:** 284 (March-April) 1944.

The author's conclusions are as follows:

1. The Lempert Endaural Fenestration Operation improves hearing from a level below the useful range to a useful level.
2. I consider the five year period an adequate one on which to base the statement that some patients have had a permanent improvement in hearing.
3. If there has been no retrogression in hearing for one year following operation, the restoration of hearing will probably be permanent.
4. In general it may be stated that the results obtained by the fenestration operation will be in direct proportion to the ability, training, and experience of the surgeon.

Kinney, C. E. A Critical Review of the Fenestration Operation: Report of Cases, *Laryngoscope* **55:** 117 (March) 1945.

The fenestration operation is a distinct advance in the therapy of stapedial ankylosis. The operation is indicated only when the hearing of air-conducted sounds is progressively impaired in the absence of lesions elsewhere in the hearing mechanism. The endaural approach is used.

Improvement of the methods of testing, particularly of those for the testing of bone conduction, will enable otologists to select cases for this procedure more adequately.

The author prefers the combination of analgesia and local anesthesia recommended by Lempert, combined with continuous intranasal administration of oxygen in order to reduce the bleeding and the restlessness of the patient.

Closing of the fenestra is still the main technical problem to be solved. At the present time it is assumed that a fenestra that remains open for six to eight months will probably remain permanently mobile.

The evaluation of the results achieved with the fenestration operation should be based on the percentage determination of hearing adopted by the American Medical Association. The author suggests putting the results into three groups:

1. *Excellent:* 80 per cent maintained for six months or longer.
2. *Good:* An increase of 20 per cent in hearing maintained for six months or longer if an excellent result has not been obtained.
3. *Poor:* Any improvement less than excellent or good. Improvement not maintained. Stationary or further impaired hearing.

Among the author's 8 patients 4 showed excellent results, 1 good and 3 poor results. The claim of 85 to 90 per cent successful results is unwarranted at this time.

Kinney, C. E. Some Questions and Answers Concerning Fenestration Operation, *Ohio State M. J.* **41:** 513 (June) 1945.

The author discusses all angles of the fenestration operation in a paper directed to the general practitioner.

The hearing is restored to the "practical level" by this operation in 80 per cent of the suitable cases. One out of 4 persons obtaining "practical hearing" begins to lose it about the fifth month, and by the eighth month the hearing is back where it was before the operation. This is due to bony closure of the window. The newly created window may be reopened, but there is no assurance that it will stay open after a second or even a third operation.

Among the 20 per cent whose hearing is not restored to the practical level, there is in one third some but insufficient improvement, in one third no improvement and in one third actual deterioration of hearing.

Age has nothing to do with the selection of a case for operation. However, it is only the occasional patient over 50 years of age who still has an inner ear that is functioning well enough to warrant operation, and this never is found in a person over 60 years of age.

Kobrak, F. Contributions to Functional Pathology of the Ear on Some Aspects of Treatment in Progressive Congenital Deafness, *J. Laryng. & Otol.* **58:** 439 (Nov.) 1943.

In progressive congenital deafness there is a significant alteration in the activity of the intratympanic musculature which is due to a spastic condition of the muscles secondary to primary changes in the cochlear nerve. Taking this as the working hypothesis, the author has attempted to alter the abnormal condition of the nervous system by suitable therapy. No distinction is made between the two types of progressive congenital deafness, the primary cochlear and the ankylostapedial or "classical" otosclerosis. From the standpoint of pathology both types are interrelated. The author claims that a combination of calcium-phosphorus therapy and vitamin D therapy has been successful in a number of cases. In a small number of them the favorable results were confirmed by audiometric tests. Elimination of factors deleterious to the hearing, such as nicotine, acetylsalicylic acid and intense noise, is also important.

It is not possible to alter the basic pathologic changes in congenital deafness. It may be possible to improve the patient's condition by making a new pathway for the sound waves (surgical fenestration of the labyrinth) or by altering two variable factors, the pressures in the middle ear and the labyrinth, and varying the activities of the intratympanic muscles and so of the damping apparatus. Surgical fenestra-

tion can improve the access of sound waves to the organ of Corti; however, one must remember that this alteration of the anatomy of the inner ear must interfere with any physiologic or pathologic damping mechanism. It is questionable whether this added access of sound is of ultimate benefit if the organ of Corti is left unprotected by the damping mechanism.

The pressure in the labyrinth can be altered by extensive thecal puncture, either suboccipital or lumbar. Air inflation has a beneficial effect in some cases of congenital deafness even without any evidence of tubal obstruction or any catarrhal condition. Sometimes patients have shown improvement, particularly in the cochlear type, from one to four years after the politzerization without any improvement in the threshold values revealed by tuning forks or audiometer. Such findings can be explained as an effect on the intratympanic musculature and so on the damping. The differences observed can be explained also on this hypothesis: The "efficiency"—not the "sensitivity"—is improved.

The tympanic muscles are regarded as operating in a key position by regulating normal and pathologic conditions and thus to some degree encouraging attempts at medical treatment of congenital deafness. The key position is part of the vicious circle: cochlear nerve degeneration→(spastic) hyperactivities in the tympanic muscles→labyrinthine hyperpressure→secondary cochlear lesion. The restricted medical therapy is directed against this vicious circle in one way or another. These are the changes with more or less advanced deafness. More promising seem to be the measures for combating early and even potential congenital deafness. The detection of the early form is the task of special ways of individual and familial diagnosis.

Kopetzky, S. J. Symposium: Progressive Deafness; Present Status of Medical and Surgical Therapy for the Deafened, *Laryngoscope* **54:** 217 (May) 1944.

Surgical treatment (fenestration of the labyrinth) should be reserved for those patients with otosclerosis who present an evident rapid deterioration of hearing in spite of medical treatment and for those whose audiometric threshold is below the level of practical hearing; namely, patients whose loss is about 40 decibels (average). The medical treatment should consist in the handling of allergies and of water imbalance by suitable medication and diets, the removal of excess lymphoid tissue in Rosenmüller's fossae, the introduction of radium or radium emanation, the injection of benzylcinnamate (Jacobson) or administration of vitamins, preferably carotene in oil, 25,000 units a day, together with yeast concentrate, 4 grains (0.26 Gm.), three times a day, and one subcutaneous injection of anterior pituitary extract a month. Among 97 patients treated with vitamins, 85.5 showed an average hearing gain of 8.92 per cent, and 13.4 per cent, an average

hearing loss of 9.22 per cent; in about 1 per cent the hearing threshold remained stationary. Appreciable gains or losses were observed to occur largely in the first six months of treatment. In 64 of the patients the disease was probably otosclerosis; 52 of them showed an average hearing gain of 8.6 per cent; in 12 there was a decrease in hearing during the treatment. Sixteen patients with discharging ears showed an average hearing gain of 8.94 per cent. The author concludes that the hearing may be held at its existing level when one is dealing with chronically discharging ears which present indications for surgical intervention. This seems to be true even though there is a family history of deafness.

He thinks that the results of treatment, whether this is medical or surgical, are about the same so far as the hearing is concerned. Surgical treatment should be reserved for those ears which fail to respond to nonsurgical therapy and which while under observation show definite recorded evidence of progressive loss in hearing acuity. At the present stage of knowledge the results of surgical treatment cannot be predicted. The use of hearing aids should be more generally advocated. They play a useful part in therapy, and they enable the patient to hear.

Lempert, J. Lempert Fenestra Nov-Ovalis with Mobile Stopple: A New Advance in the Surgical Treatment for Clinical Otosclerosis Evolved as a Result of a Research Study of One Thousand Cases in Which Fenestration Has Been Performed During the Last Seven Years, *Arch. Otolaryng.* **41:** 1 (Jan.) 1945.

Since the diagnosis of otosclerosis cannot be made with certainty unless it is confirmed by histologic observation of the affected temporal bone, the author suggests that deafness suspected to be due to otosclerosis should be referred to not as "otosclerosis" but as "clinical otosclerosis," a term which at once signifies that the deafness suggests, but is not positive evidence of, the presence of otosclerosis.

The statement is made that fenestration "cures" clinical otosclerosis by rendering the lesion "symptom free" despite the fact that the suspected otosclerosis may remain and even continue to progress. A newly created window in the bony capsule of the vestibular labyrinth replaces the functionally impeded oval window. This permits the perilymph and the endolymph to be again freely mobile to airborne sound.

Since deafness resulting from otosclerosis is progressive and usually results in total irreparable loss of hearing because of secondary degeneration of the organ of Corti, and since there is no known satisfactory medical treatment, and since both experience and time have shown that in a large percentage of patients this form of deafness can be "cured" only by surgical treatment, fenestration is indicated when the hearing for airborne sound drops below the 30 decibel level in the low conversational frequencies, provided that active suppuration of the middle ear is absent

and provided that there is lack of positive evidence that the membrane of the round window is functionally impeded, and provided that there is reason to suspect that there still exists in the ear chosen for operation a reservoir of cochlear nerve function in excess of what is being utilized or tapped by the functionally impeded air conduction mechanism, and that this reservoir is sufficient to permit improvement of hearing as a result of improving the air conduction mechanism.

Hearing for bone conduction as determined with the audiometer or tuning forks is not an infallible index of cochlear nerve function. Instead of saying that fenestration is indicated when the hearing by bone conduction in the 512, 1024 and 2048 frequencies has not receded to a level lower than 30 decibels one should say that the operation is indicated when the impairment of hearing in the conversational frequencies is not the result of degeneration of the cochlear nerve. The significance of the amount of bone conduction hearing for individual sound frequencies in a particular case and the relation of this to the degree of cochlear nerve function are but little understood.

In a number of cases in which the hearing for bone conduction was down below the 30 decibel level, practical hearing could be restored by operation, and at the same time the hearing for bone conduction was also improved.

In patients with normal bone conduction or with equal bone conduction losses the ability to understand speech does not always go parallel to their air conduction losses in the conversional frequencies. Sometimes those with marked air conduction losses understand speech better than those with less marked losses. Accurate determination of the decibel level of bone conduction hearing is not always possible; the most accurately determined level for individual sound frequencies is not always representative of the degree of cochlear function still present in a deafened ear. An accurate, infallible test by which the cochlear nerve function within an ear deafened to air conduction in clinical otosclerosis may be determined is yet to be developed. In order to overcome these difficulties, the author suggests the construction of an audiometer for testing the hearing of speech by air conduction and bone conduction instead of the hearing of sound frequencies. No patient should be advised to be operated on before his loss of hearing by air conduction has reached at least the 40 decibel level in most of the conversational frequencies.

When both ears are deafened to the degree that there is no longer "practical hearing" in either ear, the ear suspected to possess the greater reservoir of cochlear function should be chosen for operation, even if that ear has the lesser degree of air conduction loss. When the reservoirs of cochlear nerve function are equal, the ear with the poorer air conduction should be chosen. If tinnitus is present in one ear or is more severe in one ear than in the other, the ear with the

tinnitus or the more severe tinnitus should be chosen if the cochlear nerve function is still good enough in this ear and if the hearing for air conduction is below the practical level, even if the hearing for air conduction in the other ear is much worse. "If the operation is successful, the tinnitus disappears in 95 per cent of the cases and remains absent as long as the hearing improvement is maintained."

The degree of improvement of air conduction hearing can be maintained continuously if osteogenesis does not close the fenestra newly created in the bony capsule of the vestibular labyrinth and if the endolymphatic labyrinth does not undergo postoperative inflammatory changes severe enough to result in some degree of permanent damage of the organ of Corti.

The author discusses his attempts to prevent bone from regenerating in the newly created fenestra. 1. He created the fistula with a dull dental finishing burr; burnished the freshly cut walls with a 22 karat solid gold, steel, lead or silver burnishing burr; silver-plated the freshly cut bony walls with silver amalgam; burnished the walls with electrocoagulating current, and irradiated the freshly cut walls with roentgen rays. 2. He carefully removed bone slivers from the fistula and the inner surface of the tympanomeatal membrane and removed bone sand from the fenestra. He covered the fistula with the part of the tympanomeatal flap representing Shrapnell's membrane. 4. He created the fistula in the surgical dome of the vestibule. 5. He inserted metal obturator frames in the fistula.

In some cases the initial hearing gain was lost in spite of the fact that the fistula stayed open. This was due to a postoperative inflammation of the labyrinth, which in most, but not in all, cases recedes without permanent damage having been done to the organ of Corti. The inflammation starts in the tympanomeatal flap which covers the fistula.

In order to prevent postoperative labryrinthitis, sulfadiazine was administered prophylactically and the wound was filled with melted paraffin, but there was no appreciable decrease in the frequency or the severity of the labyrinthitis. By leaving the endosteal membrane intact, it was possible to reduce the inflammation, but the fistula closed rapidly. Covering the periosteal surface of the fenestra with a disk of cartilage did not prevent the infection or maintain the hearing improvement.

The normal oval window is not an open window but is closed by the bony footplate of the stapes; this bony closure, however, is mobile. It is not necessary to keep a newly created fenestra open in order to maintain the improved hearing obtained by fenestration. One may close the gap and still the improved hearing will be maintained, provided one can keep the means of closure mobile. This was achieved by inserting into the newly created window a cartilage stopple, taken from the spine of the helix. The stopple should completely obliterate

and close the newly created window; its inner surface, facing the perilymph space, and its outer surface, facing the epitympanum, should respectively reach and extend approximately 0.5 mm. beyond the endosteal and periosteal surfaces of the bony rim of the fenestra.

Postoperative serous labyrinthitis was prevented and the hearing improvement was maintained in every case in which he thus operated.

An end result should not be reported as successful until at least one year after operation and only when, at the end of that year, the hearing improvement has failed to show any continuous inclination to drop below the best obtained postoperative level. Reporting the average number of decibels gained for the conversational frequencies is misleading; the operation can be regarded as successful only if the hearing is permanently improved to the 30 decibel level or better.

The operation does not endanger the patient's life, but is, as any other operation, not free from unforeseen sequelae, e. g., embolism or coronary thrombosis. Transient facial paralysis may occur occasionally. In rare cases, postoperative labyrinthitis damages the organ of Corti, and the hearing is further decreased instead of improved.

The end results in 1,000 cases in which the author operated were as follows: Among 815 cases in which bone conduction was good, complete rehabilitation for social and economic contacts was achieved in 511 (70 per cent) and partial rehabilitation in 92 (10 per cent). Among 185 cases in which bone conduction was poor, there was complete rehabilitation in 42 (23 per cent) and partial in 39 (21 per cent).

Of 384 patients operated on more than three years prior to the report, 309 had good and 75 poor bone conduction. Of those with good bone conduction, 61 per cent had successful results; among those with poor bone conduction, 16 per cent.

In 140 of the 1,000 cases there was partial or complete closure of the fistula; 88 closures occurred in the first 300 cases, in which the fenestra was made into the prominence of the lateral canal; 52 occurred in the last 700 cases, in which the nov-ovalis technic was employed.

The following complication and sequelae were observed: Two patients died from coronary thrombosis within two weeks after operation; another, four weeks postoperatively, of an abscess of the left temporosphenoidal lobe. In 1 patient a temporosphenoidal lobe abscess was successfully opened; another with labyrinthogenic meningitis and sinus thrombosis recovered. Transient facial paralysis was encountered in 14 patients; all but 1 recovered completely within periods ranging from two or three weeks after the onset.

A successful operation will stop the secondary degenerative changes in the cochlear nerve. This can be deduced from the observation that "the hearing in the ear not operated on continues to follow its unfavorable course of both middle and inner ear depreciation."

A hearing aid does not stop the progress of the disease. It "lulls the patient into a false sense of security which is bound to be followed

by a sudden awakening to the fact that the formerly useful aid ceases to be an aid, and that the one time opportunity for regaining and continuously maintaining physiologic hearing by fenestration was missed by wearing this aid and is never to return."

Patients who wore a hearing aid before a successful operation will tell one that the benefits they had obtained by the use of a hearing aid cannot at all be compared favorably with the advantages they now enjoy as a result of the operation.

Lempert, J., and Wolff, D. Histopathology of the Incus and the Head of the Malleus in Cases of Stapedial Ankylosis, *Arch. Otolaryng.* 42: 339 (Dec.) 1945.

This is a report of the microscopic observations made on the incus and the head of the malleus in 115 cases of "clinical otosclerosis." In all but 5 specimens the authors found changes which they regard as pathologic. Typical otosclerotic foci as reported by Covell (1940) were not found in the ossicles. The changes consisted in:

1. Distortion of the shape of the ossicles due to:
   (*a*) Irregular bony contours (57 per cent of the cases)
   (*b*) More or less extensive fibrotic replacement of bone (23 per cent of the cases)
   (*c*) Evidence of altered stresses and strains in the ossicular chain [e. g., new bone deposited over the periphery of the old surface, or distorted shapes of the ossicles produced by other than the just mentioned processes]
2. [What the authors describe as] Blue mantles [14 per cent of the cases]
3. Changes in the marrow spaces, which included: (*a*) tortuosity of vessels [19 per cent], (*b*) venous stasis [31 per cent], (*c*) arterial congestion [14 per cent], (*d*) periarteritis [24 per cent], (*e*) endarteritis [17 per cent] leading to fibrosis of the marrow spaces, (*f*) osteoporosis [14 per cent.].
4. Pathologic changes in the ossicular joints, which included: (*a*) erosion of cartilage, (*b*) lipping in cartilage, (*c*) deposition of calcium, (*d*) overgrowth of atypical bone

It seems highly probable that in the larger percentage of pathologic ossicles found in the series from otosclerotic patients the changes are in part at least degenerative changes arising from disuse engendered by ankylosis of the stapes. No correlation was found in regard to blood values for calcium and phosphorus. Phosphatase was not determined.

Lewy, A. Possible Value of Nontoxic Concentrations of Fluorine in the Prevention of Deafness from Otosclerosis and Fibrosis: Its Possible Prevention in Other Diseases, *Arch. Otolaryng.* 39: 152 (Feb.) 1944.

It is claimed that the use of drinking water which contains fluorine in nontoxic concentration (about 1 part per million) reduces the incidence of dental caries. This is evidently brought about by a change

in the metabolism of the dental tissues rather than by local stasis. In order to study the possible value of fluorine in the prevention of deafness, the hearing of 132,572 school children was tested; 4.7 per cent of them showed defective hearing. In 109,869 who came from regions wherein the water did not contain fluorine the incidence of defective hearing was 4.9 per cent. In 20,488 children from regions wherein the drinking water did contain fluorine the incidence was only 2.8 per cent. In Chicago the drinking water is fluorine free, and the incidence of defective hearing among 21,000 children was 4.3 per cent.

These figures are, in the author's opinion, sufficient to overcome to a large extent the elements of coincidence and statistical error.

Much remains to be done with this idea. Wider investigation may upset it. A more detailed correlation of the defective persons as to family history and exact diagnosis is necessary. One cannot know how many potential otosclerotic or fibrotic ears are in the group. The few pairs of identical twins with a deafness heritage now being studied by Fowler may offer an occasional opportunity for controls; study of blood serum calcium and phosphorus and the effect of the serum of otosclerotic patients on labyrinthine bone (Grahe and Griebel) might be extended to include the effect of fluorine on such bone as well as its effect on the endocrine system, especially the parathyroid glands.

Lowy, K. Functional Studies on Labyrinthine Fenestration in Animals, *Laryngoscope* **55:** 6 (Jan.) 1945.

The author's summary is as follows:

In pigeons, otosclerotic deafness was imitated by immobilizing the columella. The cochlear potential, as an indicator of intracochlear vibration, was recorded before and after fenestration of the anterior semicircular canal.

For practically all frequencies and intensities tested, fenestration leads to an increase in cochlear microphonics, the gain being greater for higher intensities. This latter observation may be of clinical importance since for speech the patient predominantly uses intensities well above threshold. It might, accordingly, be of interest to include the [loudness] balance test in the routine examination of the candidate for operation.

Cauterization for the fistula reduces the gain only slightly.

Removal of part of the membranous canal leads to considerable reduction in cochlear response.

The response to bone-conducted sound is not improved by fenestration. For higher intensities, there may be some decrease.

Removal of perilymph does not improve the electric response in artificial conduction-deafness. It is consequently believed that escape of inner ear fluid is not responsible for the immediate hearing gain after fenestration.

Lowy, K. Functional Studies on Fenestration of the Labyrinth in Animals, *Arch. Otolaryng.* **41:** 376 (May) 1945.

For three and a half years functional studies were made on the effects of fenestration in animals. Two experimental methods were used:

1. The acute, in which the electric response of the animal's cochlea is used as a criterion of function.
2. The training of an animal to respond to certain frequencies and the determination of its hearing threshold.

The first method was applied mostly to a study of pigeons (Lowy, K.: *Laryngoscope* **55:** 6, 1945).

The second method was applied to 9 monkeys (monkeys being the only animals with anatomy suitable for the Lempert operation and flap). They were trained to respond to sound. One ear was then destroyed, and the incus was removed from the other. Removing the incus has about the same functional effect as fixing the footplate of the stapes. This was demonstrated in experiments on cats.

In 1 case Pohlman's prosthesis was tried. It was placed against the oval window, and remarkable improvement of hearing occurred. The author suggests that placing this prosthesis against the membrane be tried in cases in which fenestration alone has not been successful.

"Does the electric response really test the hearing? We can now distinguish between the nerve and the cochlear response, and we believe that the cochlear response in the live animal is a good measure."

MacDonald, P. G. First Experimental Use of Cartilage to Maintain a Patent Fenestra in Bone, *Arch. Otolaryng.* **41:**241 (March) 1945.

The author made two openings side by side in the temporal bone of a cat. Into one of these openings he put a hyaline cartilage button from which the center had been punched. The other opening was left open. After four and a half months the cat was killed. The fenestra into which the cartilage button had been placed remained unchanged. The other one had closed completely.

Other experiments using hyaline and "white fibrous and yellow fibrous" cartilage are being made by the author. He uses the temporal bone for these experiments as it is more accessible than the dense bone around the semicircular canals.

> . . It is well known that it is easier to keep a fenestra open in the dense bone around the semicircular canals than it is to keep an opening patent in the squamous portion of the temporal bone. . . . if the cartilage will maintain a fenestra in the squamous portion of the temporal bone, it certainly should maintain an opening in the dense bone around the labyrinth.

The author claims priority for the use of cartilage to keep fistulas open and for examining the comparative values of the different types of cartilage obturators.

Martin, R. C. Fenestration Operation for Deafness, *California & West. Med.* **62:** 311 (June) 1945.

The author discusses briefly the historical development of the operation, its present status, the indications and the results. He thinks that a fair estimate of the results, to be obtained from trained operators throughout the land, will be somewhere in the region of 50 per cent showing lasting improvement, with the hearing raised to the realm of usefulness. He sees no reason to suppose that the degeneration of the nerve will be halted by a successful operation but feels that only further observation will throw light on this claim.

There are no advantages of the operation over the wearing of a hearing aid, which will produce the same amount of improvement in the hearing of human speech if the patient is willing to wear the hearing aid.

Overenthusiasm and injudicious publicity may endanger a purely scientific approach to the study, whether the operation is worth while or not. One should be extremely careful in compiling operative statistics, in order to avoid doing irreparable damage to the repute of an operation of merit.

Meyer, M. Experiences with Eighty Cases of Degenerative Deafness With and Without Otosclerosis, Treated with Major Suboccipital Puncture: Sixth Communication About the Problem of Cerebro-Spinal Fluid Pressure and Inner Ear, *Pract. oto-rhino-laryng.* **5:** 1, 1943.

Major suboccipital puncture was used in the treatment of 153 diseased ears of 79 patients; the hearing was improved in 94 diseased ears of 51 patients. Otosclerosis with ankylosis of the stapes occurred in 50 diseased ears of 28 patients, and labyrinthine atrophy occurred in 44 diseased ears of 23 patients. Tinnitus was present in 108 ears of 55 patients. It was markedly improved in 58 ears of 36 patients. Of these 36 patients, 25 had otosclerosis in 43 diseased ears, and 11 had labyrinthine atrophy in 15 ears. The hearing was tested with tuning forks, Galton whistle and monochord, and auditory graphs were drawn for quantitative determination of hearing. The improvement in hearing in cases of otosclerosis was confined to the higher notes; in labyrinthine atrophy it was more or less equally distributed over the entire range.

The effect of suboccipital puncture is explained as due to the reduction of the cerebrospinal and perilymphatic pressures, which leads to a recovery of the degenerating sound-perceiving, and possibly also of the liquor-producing, elements of the cochlear duct. The lack of improvement in the lower range in otosclerosis is explained by the presence of the ankylosis of the stapes, which of course remains uninfluenced by the puncture.

It is impossible to heal the primary diseases leading to degenerative deafness by means of extensive suboccipital puncture. Only the symptoms of impaired hearing and tinnitus can be improved. The degrees of improvement are various but sometimes very satisfactory. Concerning their permanence nothing definite can yet be said. In 12 of the cases the improvement has been maintained over one, sometimes even over two years, but relapses may be expected at any moment. Considering the relative smallness of the operation, even a passing success may be valuable, since the puncture can be repeated. But as yet there are no experiences to that effect.

Miller, L. M. New Hope for the Deaf, *Hygeia* **23:** 98 (Feb.) 1945.

The author discusses otosclerosis and its surgical treatment for the laity, particularly Lempert's nov-ovalis technic with mobile stopple. The operation is comparatively safe, painless and bloodless. The mobile

stopple has solved the problem of the prospective closure of the fistula. Deafness caused by otosclerosis can be "cured" by the operation in 98 per cent of cases, provided the technic is correct.

Nemirovsky, S. Absolute Bone Conduction: Its Importance in Otospongiosis, *Rev. otorrinolaring.* **1:** 325, 1942.

This article is not available.

Pedersen, T. E. The Fenestration Operation for Deafness: Psychological Factors, *Am. J. Nursing* **45:** 726 (Sept.) 1945.

If otosclerosis causes deafness during adolescence, the symptomatic emotional attitudes of the deafened progress with the physical shutting off of sound. Young people at this age ridicule each other mercilessly, and the butt of their ridicule is often some one with a disability. This drives the boy or the girl with the disability away from group recreation, which is so needed for the development of the personality. If hearing is restored by means of the fenestration operation, the adolescent again becomes a contributor to all activities, and with his acceptance by his companions normal attitudes are restored.

If the disease becomes a handicap in the twenties, during the period when the subject is becoming oriented to new associates in a work career, paranoid attitudes can and do develop. A fenestration operation may prevent eventual disintegration of the personality.

In the middle years there is only partial success. The nervous system may have sustained irreparable harm, and a complete cessation of the nervousness cannot be expected to result from the removal of the cause. There is, however, a lessening of the ideas of specific persecution when hearing is restored.

In advanced years, even though there may have been an adjustment of hearing loss, beneficial results follow the operation. The most dramatic effects of the fenestration operation are obtained for those who have, because of deafness, become psychotic. It is an accepted fact that there is a relationship between the personality of a person, his psychic disturbance and his physical symptoms. Relief of the affliction has resulted in relief of conflict. If "practical hearing" has been restored there is a recovery from abnormal attitudes within a short time.

Perlman, H. B. Radiation of the Ear, *Laryngoscope* **54:** 255 (June) 1944.

The normal peripheral auditory apparatus can withstand massive roentgen radiation without structural or functional impairment. The dosage should not exceed 15 roentgens (r) per minute and 300 r per day. Conduction deafness of many months' duration due to carcinoma with resulting tubal obstruction and exudative catarrh can be completely relieved by roentgen radiation. The healing of clean perforations in the cochlear capsule of the rabbit can be delayed but not prevented by irradiation of the ear with 1,500 r.

Perlman, H. B. Physics of the Conduction Apparatus, *Laryngoscope* **55:** 337 (July) 1945.

The author's summary is as follows:

Some of the physical properties of the human conducting mechanism were determined on fresh temperal bones. Studies along these lines can help the otologist to understand how the normal conducting mechanism functions as an acoustic instrument and the particular manner of its response to sound waves. The significance of these properties in determining the response of the middle ear structures to sound waves is pointed out.

Quisling, S. Treatment of Deafness, Ear Noises and Dizziness by Hypothermic Therapy, *Journal-Lancet* **65:** 219 (June) 1945.

A method of treatment of otosclerosis, Ménière's disease and other forms of disturbance of the eighth nerve due to faulty blood supply or to changes of pressure of the endolymph of the labyrinth or to both is described. Several illustrative cases are reviewed in which beneficial results were noted. No audiometric charts are given, although the author mentions that audiograms were "taken in certain instances." Essentially the treatment consists of "freezing the skin area" over the mastoid process and the petrous portions of the temporal bone with an ethyl chloride spray for a short period at intervals of three to seven days over a period of at least two months. This hypothermic therapy was based on the findings (1) that the phenomenon of paracusis willisiana can be reduced by cold as well as by vibratory means, (2) that the cochlear division as well as the vestibular division of the eighth nerve is markedly sensitive to cold and (3) that decrease of the blood supply of the labyrinthine capsule will cause deafness, head noises and dizziness. The author states that the mechanism of hypothermic therapy appears to be an increase of the blood supply of the labyrinth and a varying of the pressure of the endolymph, with a resulting exchange of tissue fluids beneficial to the eighth nerve endings.

Shambaugh, G. E., Jr. Comparison of Improvement in Hearing Following the Fenestration Operation with That Obtained by Wearing a Hearing Aid, *Arch. Otolaryng.* **41:** 189 (March) 1945.

Shambaugh employs the nov-ovalis technic of Lempert, which he modifies by irrigating the field constantly and using the binocular dissecting microscope while the fistula is being made. He bases his statistics on the average number of decibels gained for hearing of the speech frequencies whether the level of practical hearing was reached or not. He found the hearing improved in 88 per cent of 321 cases six months after operation and in 90 per cent of 201 cases one year or more after operation. With a new type of audiometer, measuring the hearing for speech rather than that for pure tones, it was observed that patients who experienced an average or greater than average acous-

tic gain from the fenestration operation obtained as good or better hearing of speech than they formerly obtained by using a hearing aid. Patients experiencing a less than average improvement (less than 20 decibels) did not hear as well as they had with a hearing aid.

The prospective ideal subject for the fenestration operation may be told that he has approximately a 90 per cent chance of a lasting improvement of his hearing and approximately a 70 per cent chance that the hearing will equal or surpass that obtained with a hearing aid.

Shambaugh, G. E., Jr.; Leggett, E. A., and Wojniak, F. J. Chronic Progressive Deafness Including Otosclerosis and Diseases of Inner Ear, *Arch. Otolaryng.* **39:** 434 (May) 1944.

This is a summarization of articles bearing on this subject which were published in 1941-1942.

Shambaugh, G. E., Jr., and Cutler, M. H. Chronic Progressive Deafness, Including Otosclerosis and Diseases of the Inner Ear, *Arch. Otolaryng.* **41:** 147 (Feb.) 1945.

This is a critical review of articles bearing on this subject which were published in 1943.

Shambaugh, G. E., Jr. Fenestration Operation for Otosclerosis, *Am. J. Nursing* **45:** 725 (Sept.) 1945.

Discussing the problem for nurses, the author states that in those who are ideal subjects for the operation there is an 80 per cent or more chance of a lasting improvement of hearing and that there is approximately a 10 per cent chance of a permanent improvement sufficient to equal that obtained with a hearing aid.

Shambaugh, G. E., Jr. Fenestration Operation: Clinical Study of Permanence of Its Results, *Quart. Bull., Northwestern Univ. M. School* **19:** 259, 1945.

The author reviews the results of 800 operations performed within seven years. Fifteen were done with the original Lempert technic; 30, with the Lempert technic modified by the addition of constant irrigation to keep the fistula constantly clean from bone dust; in 63 operations a binocular microscope was used in addition to the irrigating apparatus; in 530 operations Lempert's nov-ovalis technic was used; in the technic used in the last 172 operations the position of the fistula was shifted and a plastic skin flap was applied in order to enhance the conduction of sound vibrations from the tympanic membrane to the fistula.

In 30 cases revisions were performed. There were no deaths and only one serious complication—facial paralysis, from which the patient made an incomplete recovery.

Closure of the fistula to sound occurred in 51 of the 800 patients, or 6.5 per cent. Eighty-two per cent of all closures occurred in the first year after operation and 98 per cent within two years.

Of the fistulas made with the original Lempert technic, 53 per cent closed; addition of irrigation reduced the closures to 23 per cent; irrigation, use of the microscope and the nov-ovalis technic reduced the percentage to 4. With the latest technic there have been so far no closures. With the original Lempert technic and irrigation an improvement of 10 decibels or more for the three conversational frequencies was permanently (over two years) maintained in 21 per cent of the patients; with that technic, irrigation and use of the microscope, in 49 per cent, and with the nov-ovalis technic, in 77 per cent. Another 9 per cent of patients show a "significant" hearing improvement.

Smith, J. M. Report of Eighty-Five Fenestration Operations for Otosclerosis, *New York State J. Med.* **44:** 1771 (Aug. 15) 1944.

In his first 32 operations, reported in 1943, the results were good in approximately one third. The proportion was greatly improved in the 53 subsequent operations. This the author attributes to a change of location of the fistula. He now follows Lempert's nov-ovalis technic and places the fistula in the dome of the vestibule anterior to the ampullated end of the horizontal semicircular canal. In this location it can be made wider. The bone forming the dome of the vestibule is much thinner, and there is no bone at the bottom of the fistula as there was when it was made over the length of the external semicircular canal. The use of a 2 per cent aqueous solution of gentian violet helps to keep down secondary infections of the operative cavity, but it should not be used on the dome and should be kept away from the edges of the flap in the early stages of the after-treatment until the attic and middle ear spaces are thoroughly sealed with granulations.

The ideal indication for the fenestration operation is a typical clinical syndrome of otosclerosis (with ankylosis of the stapes) occurring before there is any serious impairment of the auditory nerve. An intact drum with a firmly healed perforation, a small calcareous deposit or a retraction or a loss of color and an old infection of the middle ear and mastoid process which has long since subsided leaving the drum intact are not regarded as contraindications. It is important that the large number of people afflicted with this disease be informed of the possibilities of surgical relief while there is still sufficient nerve function remaining to convey the sounds to the internal ear. There is no way to guarantee, at the present time, that the fistula will not close. However, in properly selected cases there is an excellent chance of securing a successful and lasting result. Without operation there is gradual and progressive loss of hearing followed by slow deterioration and loss of nerve function, resulting finally in severe or total deafness with no prospects of help from an operation, from a hearing aid or from any other source. In persons with partially damaged nerve in whom the impairment of the nerve function is not too marked, there is still a chance of checking

the progress of the disease and maintaining serviceable hearing. In 6 patients with marked loss of hearing for both air and bone conduction the operation was unsuccessful; in 2 of them it was followed by a deterioration of hearing. A successful result in this type of patient could be explained only if there was a concealed reservoir of nerve function present before operation. There is, however, at the present time, no method of successfully testing and determining the presence of this reservoir.

How to prevent osteogenesis or fibrosis from closing the fistula constitutes the paramount problem in this work. The most successful operations were those in which the bone was removed and the endosteum powdered and removed without disturbing the translucent outer wall of the membranous labyrinth. Fistulas which have remained open for nine to twelve months have consistently maintained the gain in hearing (in some cases almost four years), and there is every reason to believe that they will stay open indefinitely.

If the operation is not successful and the fistula closes despite the proper indications and technic, in the vast majority of cases the hearing will merely recede to its preoperative level.

Clinical otosclerosis is a progressive disease, and many patients afflicted with it reach a point where a hearing aid is completely useless. A successful fenestration not only makes it possible to discard the hearing aid completely but restores useful hearing and checks the progress of otosclerosis.

Sullivan, J. A. Indications for, and End Results of, Fenestration Operation, *Canad. M. A. J.* 53: 543 (Dec.) 1945.

The author reviews the observations and the results of operations in 410 cases.

The cartilaginous stopple was used in 25 cases. With respect to the principle of the stopple, the author agrees that it seals the perilymphatic space and separates it from direct contact with the tympanomeatal flap, thus preventing postoperative serous labyrinthitis. The stopple functionally simulates the normal stapedial footplate, dampens loud air-conducted sound and protects the organ of Corti from acoustic trauma. He does not think that the stopple gives in all cases the early brilliant results for practical conversation that the open fenestra does. He advocates the routine use of the stopple but suggests that after an eight month period, when one can feel sure that the attempt at osteogenesis has been defeated, the wound should be reopened and the stopple removed, provided, of course, that the improvement of hearing has not improved to a 30 decibel or "practical conversational level." The author gives his results as follows: "complete rehabilitation for social and economic purposes maintained for at least twelve months postoperatively in 246 cases; partial rehabilitation in 17 cases; no change in 21 and

deterioration of hearing in 15 cases. The fistula closed in 27 cases; in 8 of these a revision has already been done and in 6 the fistula now remains open. Of the 15 cases with postoperative deterioration of hearing, revisions were performed in 9, which resulted in further inflammatory reaction within the labyrinth and a resultant further loss of function. In 3 cases the membranous labyrinth was injured at the time of operation. In 1 case the membranous labyrinth was destroyed by the author because of severe and persistent vertigo. In 1 case decompression of the facial nerve was performed for facial paralysis and the labyrinth inadvertently destroyed. All of these untoward incidents occurred during the first two years of the author's work.

The author then describes the signs and symptoms of otosclerosis as an index to the type of case which is suitable for fenestration. The loudness balance tests are more reliable than is the method of pure tone audiometry and the bone conduction interpretation. Through this test the otologist is able to determine to a certain degree whether a patient will hear as well as a person with normal hearing receiving sound the same degree above threshold or whether he will recruit in loudness and in that way hear sounds above threshold louder than the patient suffering from a like degree of obstructive deafness.

Voss, O. Old and New Facts Concerning the Problems of Otosclerosis, *Med. Welt* **13:** 1011 (July 22); 1950 (July 29) 1939.

This is a general review of the problem. Ankylosis of the stapes occurs in only a minority of cases (31 per cent, according to M. Weber). In a group of cases a degeneration of the nerve end organs in the cochlea takes place. This is explained in some of the cases by the fact that the otosclerotic foci advance into the channels containing branches of the vena cochlea and the vena cochlea itself, with subsequent stasis, followed by atrophy (O. Mayer). In the majority of cases, however, the cause of the neural degeneration remains unknown. The diagnosis of a cochlear involvement due to otosclerosis without ankylosis of the stapes cannot be made but only suspected in those cases in which it develops in the course of puberty, gravidity or parturition. At such times it is made probable if inner ear involvement of one ear is combined with typical otosclerosis of the other ear.

Vestibular symptoms may be due to bone growing into the inner ear or to vasomotor changes. In rare cases a positive fistular symptom is present (Neumann Ruttin). It is explained that bone has been destroyed at the upper margin of the promontory, with broadening of the annular ligament in this area, through the development of an otosclerotic focus. Paracusis willisiana is, according to the author, a thiotropy. This term denotes the property of certain gels to be liquefied by intensive shaking and to return after that to their former condition. Wood succeeded in liquefying thiotropic gels by high frequency sound waves.

In the majority of cases cerumen is missing in the external canal, owing to a local metabolic disturbance of the sebaceous glands. The drum is thin and transparent and shows, sometimes, a reddish glow from the promontory. The tubes are patent. The tuning fork findings are discussed and the importance of Gelle's test stressed. Runge's test is also recommended. "Filling" of the external canal of a person with normal hearing doubles the perception time for a tuning fork vibration coming from the region of the mastoid process; the same test of a person with ankylosis of the stapes leaves the perception time unchanged. The various etiologic theories about the disease are thoroughly discussed, otosclerosis seems to follow a dominant hereditary trait but there is no definite proof for a sex-linked inheritance.

Gravidity does not always cause progression of the disease. Nevertheless an interruption of pregnancy is recommended not only in order to prevent further progress of the disease in the mother, but also for eugenic reasons. The various methods of local and general treatment are discussed in detail, and the operative treatment of Holmgren, Sourdille and Wittmaack and the unilateral parathyroidectomy of Alonso and Chiarino are mentioned. Tinnitus is often, though mostly only temporarily, relieved by spinal taps. More satisfactory results are achieved by a special method of galvanization of the ear.

Finally the use of hearing aids and the importance of lip reading are stressed.

Zangemister, H. E., and Schmidt, B. Interruption of Pregnancy on Account of Otosclerosis, *Deutsche med. Wchnschr.* **70:** 113 (March 3) 1944.

According to the author, Wittmaack's operation is the only procedure of practical importance in the treatment of otosclerosis. Among 200 patients operated on, further progress of the disease was prevented in 85 per cent. According to the authors, operation must be regarded as the method of choice. Pregnancy and delivery have unquestionably a deteriorating influence on the hearing in otosclerosis. The disease becomes manifest or progressive during the first pregnancy in 50 per cent, during the second in 90 per cent, during the following ones in 95 per cent of the patients. Twelve women in whom the operation had been performed, many of whom had deterioration of the hearing during previous pregnancies, became pregnant after the operation. In 10 of them no further deterioration was noticed; in 1 a slight subjective and in 1 a slight objective deterioration was noticed. Wittmaack's operation makes an interruption of the pregnancy or sterilization, which was recommended by many authorities, unnecessary. It may even be performed during pregnancy if a decrease in hearing is noticed.

There are still available a few copies of volume III, published in 1936, and volume IV (loose leaf), published in 1942, with subsequent yearly installments.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

PERORAL ENDOSCOPY

LOUIS H. CLERF, M.D.
AND
JAMES T. SPENCER Jr., M.D.
PHILADELPHIA
AND
COMMANDER SHIRLEY A. FUHRING (MC), U. S. N.

PENICILLIN IN THE TREATMENT OF THE RESPIRATORY TRACT

SPORADIC REPORTS of the results secured by employing penicillin in the treatment of bronchopulmonary infections have been received and have been optimistic. With an increased supply of penicillin available for experimental use it is possible now to secure preliminary reports concerning methods of administration. One is immediately impressed with the idea that this agent should be useful for instillation or inhalation in cases of bronchopulmonary infection.

Inhalation of Penicillin Aerosol.—Barach and his associates[1] presented the results of an exploratory study on the technic, the safety and the clinical effectiveness of the inhalation of penicillin aerosol in patients with bronchopulmonary infections. The findings are reported, since the response of some patients has been of an encouraging nature. Obviously there remain many questions concerning the dosage of the drug, the length of treatment and the choice of apparatus.

Their studies revealed that in 20 patients with bronchopulmonary infections the predominating organisms of the culture of the sputum were consistently absent twenty-four hours after discontinuance of the inhalation of penicillin aerosol. The blood level of penicillin attained was generally between 0.01 and 0.04 unit per hundred cubic centimeters for one hour. The aim of treatment is not to secure a high blood level but a local application of penicillin on the bronchial wall. In the group of 20 patients treated many bronchopulmonary conditions were represented, including bronchial asthma, bronchiectasis with or without

1. Barach, A. L.; Silberstein, F. H.; Oppenheimer, E. T.; Hunter, T., and Soroka, M.: Inhalation of Penicillin Aerosol in Patients with Bronchial Asthma, Chronic Bronchitis, Bronchiectasis, and Lung Abscess: Preliminary Report, Ann. Int. Med. **22**:485-509 (April) 1945.

chronic abscess, pulmonary fibrosis and emphysema and acute pulmonary abscess. In 5 patients the improvement was gratifying and seemed definitely the effect of inhalation. In 10 others improvement was moderate, and in the remaining 5 no significant clinical benefit was achieved.

Hagens and his associates [2] report their results with the inhalation method of using penicillin. They employed it in 22 patients with acute and chronic infections. The urinary and blood levels of penicillin showed that the drug is absorbed from the lungs in sufficient quantity to offer another method when penicillin therapy is indicated. Because of the local effect it may be the method of choice in the treatment of pulmonary diseases.

Inhalations of penicillin resulted in temporary improvement in bronchiectasis, but relapses occurred frequently after the treatment was discontinued. In most cases a gram-negative bacterium was encountered. Asthmatic patients suffering from a superimposed bronchial infection with an organism to which they possibly were allergic seemed to be favorably influenced by this therapy.

Acute pulmonary conditions responded satisfactorily to the inhalation treatment, and it is believed that the method can be used advantageously with children and with other patients when the usual methods of administration of penicillin are unsuitable.

In a study of 21 patients with serious respiratory disease in whom penicillin aerosolization was employed, Segal and Ryder [3] found that the clinical course of "infected bronchial asthma" was not altered, although penicillin-susceptible organisms were eradicated. Striking results were secured in patients with pneumococcic pneumonia. Five patients with bronchiectasis were treated successfully as also were 4 who had pulmonary abscess. They express the opinion that this plan of therapy has a definite place in the treatment of patients with severe respiratory disease. By this method, effective local medication, with adequate systemic blood levels for most of the penicillin-susceptible organisms, could be secured. No toxic effects were noted in the series.

After observing a series of more than 200 patients that were treated by Barach's penicillin aerosol method, Vermilye [4] highly recommended this technic as a valuable aid for the general practitioner. He con-

2. Hagens, E. W.; Karp, M., and Farmer, C. J.: Inhalation Method for Penicillin Therapy: Preliminary Report, Arch. Otolaryng. **41**:333-336 (May) 1945.

3. Segal, M. S., and Ryder, C. M.: Penicillin Aerosolization in the Treatment of Serious Respiratory Infections: Preliminary Report, New England J. Med. **233**:747-756 (Dec. 20) 1945.

4. Vermilye, H. N.: Aerosol Penicillin in General Practice, J. A. M. A. **129**:250-257 (Sept. 22) 1945.

siders it as an effective and inexpensive means of treatment which eliminates some of the present difficulties of penicillin therapy. It can be readily carried out by the physician in the office or by the patient in his home. He considers this plan of therapy of particular value in cases of respiratory infections, since a large proportion of conditions for which penicillin is required in general practice are acute bacterial invasions and the chronic infections of the upper respiratory tract.

The diseases treated successfully included acute relapsing pneumonitis due to various cocci, tonsillitis, sinusitis and sinobronchitis, pharyngitis, and asthma that is intrinsically bacterial. The technic is simple and consists in the patient's inhaling the vaporized drug with the aid of a mouth piece. The technic can be readily learned by patients, who can then carry it out unattended. Children as young as 2 years have been given courses of inhalations successfully.

Intratracheal Injection of Penicillin in Bronchopulmonary Infections.—Penicillin was used by Kay and Meade [5] in the treatment of 93 patients with chronic infections of the lungs and bronchi. They found it to be of greatest value in the treatment of acute pulmonary infections. As chronicity developed it became less effective, so that in the treatment of advanced bronchiectasis it exerted no permanent benefit. It did, however, play a useful part in the treatment of pulmonary suppuration, chronic pulmonary abscess and fungous infections in that it tended to decrease the general manifestations of toxicity, promoted symptomatic improvement and aided greatly in preparing the patient for operative intervention.

Routine bronchoscopy was done before, during and after penicillin treatment. The course of the disease and the efficacy of the therapy were noted. Specimens of secretion were secured bronchoscopically for culture and also for determining the penicillin sensitivity of the organisms present. Although the quantity of sputum decreased and the evidence of sepsis diminished, the bacterial flora was not appreciably affected.

Chronicity of pulmonary infections introduces factors which are not found during the acute state, and these seriously impair the efficiency of penicillin. These factors are mechanical, consisting of destruction of tissue, fibrosis, avascularity and bronchial occlusion.

In the treatment of bronchiectasis and chronic bronchitis the intratracheal administration of penicillin appeared to give more benefit in more cases than the intramuscular. As much as 30,000 to 50,000 Oxford units of penicillin can be applied daily in one application to

5. Kay, E. B., and Meade, R. H., Jr.: Penicillin in Infections of the Lungs and Bronchi, J. A. M. A. **129**:200-204 (Sept. 15) 1945.

the tracheobronchial tree, and excellent results were obtained by this method in patients with chronic bronchitis and minimal bronchiectasis.

May and Floyer [6] treated several patients with bronchiectasis by injecting penicillin into the trachea between the cricoid cartilage and the first tracheal ring. A local anesthetic was injected into the trachea to allay the cough reflex, and the penicillin was injected through the same needle. A solution of penicillin containing 10,000 units per cubic centimeter was prepared, and 5 to 8 cc. was injected rapidly through the needle into the trachea, the needle being withdrawn immediately and the patient urged not to cough. Posturing was employed to get the fluid into the bronchiectatic cavities. The patient was kept in the effective position for fifteen minutes after the injection.

Daily treatment were carried out for eight to ten days. One of the 3 patients treated improved and declined lobectomy. A second patient was enabled to get over the latter months of pregnancy, and the third patient, who was considered a poor surgical risk, was rendered fit for lobectomy. While it is inevitable that bronchiectatic cavities will become reinfected, and it is too early to give any opinion concerning the length of time that they will remain sterile, the treatment does provide at least temporary improvement in patients in whom the predominant organism is penicillin sensitive.

Intramuscular or Intravenous Injection of Penicillin in Bronchiectasis.—In order to determine the effects of penicillin in the treatment of bronchiectasis, Stookey and his associates [7] gave an average dose of 1,000,000 Oxford units of penicillin to each of 21 patients with chronic cough over a period of eight to ten days. Administration was either by intramuscular injection in divided doses or by continuous intravenous drip. Although the patients showed some improvement, the volume of sputum was not reduced. Studies of sputum showed that colonies of hemolytic streptococci and staphylococci were decreased.

In 20 per cent of the patients treated, mostly patients who had chronic bronchitis with periods of activity and remission, the morning sputum and cough disappeared—in some instances, within four days. It appears that penicillin will be of value in cases in which the bronchial mucosa is infected by pathogenic cocci that are susceptible to penicillin, but in cases in which there are structural changes in the lining of the small bronchioles little can be hoped for.

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6. May, H. B., and Floyer, M. A.: Infected Bronchiectasis Treated with Intratracheal Penicillin, Brit. M. J. **1**:907-908 (June 30) 1945.

7. Stookey, P. F.; Lockwood, I. H.; Mantz, H. L.; Buckingham, W. W.; Upshur, A. E., and Hibbard, B.: Penicillin Therapy in Bronchiectasis, South. M. J. **38**:98-103 (Feb.) 1945.

SULFONAMIDE DRUGS AND MANAGEMENT OF ALLERGY

In studying bronchiectasis from the standpoint of allergy and of treatment, Thomas and others [8] found that of 190 consecutive patients, approximately one half had a major allergy of the respiratory tract. A study of 75 selected patients was carried out in an attempt to evaluate sulfonamide therapy and management of allergy in treatment. In 55 of these an allergy of the respiratory tract was found to be an etiologic or complicating factor. Twenty-three patients received treatment with sulfonamide compounds as the chief or only therapeutic measure, and after four months to four years of observation 22 showed definite improvement with reduction of cough and expectoration. Twenty-one patients who were treated chiefly or wholly by management of allergy were observed from one to four and one-half years. Fifteen of these showed frank improvement with reduction of cough and expectoration. A combination of management of allergy and sulfonamide therapy was used in 31 cases. These were observed for six months to five years, and in 26 cases there was from 25 to 100 per cent improvement in cough and expectoration. The authors consider that in cases of nonsurgical bronchiectasis an adequate trial of sulfonamide therapy is definitely indicated and that in those complicated with allergy, management of this phase should be considered.

PULMONARY ABSCESS

In an analysis of 244 cases of pulmonary abscess Valle [9] admits that in spite of advances made in the treatment of other diseases of the lungs the methods so far devised for the treatment of abscess are not wholly satisfactory. It was interesting to note that in 27 per cent of cases the abscess occurred either following tonsillectomy performed with the patient under ether anesthesia or abdominal operation with the patient under general anesthesia. Of 36 children with abscess of the lung, 8, or 23 per cent, acquired the lesion as a result of aspiration of a foreign body.

In view of the postoperative occurrence of pulmonary abscess Valle recommends that careful attention be given to the mouth and the throat before an operation is contemplated and that every effort be made to prevent the patient's aspirating oral secretions and vomitus into the tracheobronchial tree. If this has occurred, the secretions and vomitus should be frequently aspirated from the bronchial tree by nasal catheter during and immediately after the surgical procedure.

8. Thomas, J. W.; Van Ordstrand, H. S., and Tomlinson, C.: The Treatment of Bronchiectasis with Chemotherapy and Allergy Management, Ann. Int. Med. **23**:405-413 (Sept.) 1945.

9. Valle, A. R.: Lung Abscess: An Analysis of Two Hundred and Forty-Four Cases, Surg., Gynec. & Obst. **81**:278-286 (Sept.) 1945.

In treatment, nonsurgical methods, bronchoscopic aspiration excluded, have been largely discarded because of their ineffectiveness and the delay of surgical drainage. Penicillin seemed to be helpful in some cases. Postural drainage was given a fair trial in treatment and this procedure coupled with bronchoscopy sometimes resulted in a cure without surgical intervention.

Of the 244 patients, 92 per cent underwent bronchoscopy one or more times. The author considers bronchoscopy as one of the most important features in the diagnosis and in the treatment, and, of 80 patients treated only by bronchoscopy, 47 showed improvement. As a diagnostic procedure bronchoscopy localizes the abscess by revealing the draining bronchus. It is invaluable in making a differential diagnosis between uncomplicated pulmonary abscess and abscess associated with carcinoma. In pulmonary abscess complicating foreign body bronchoscopy is considered imperative.

As a part of treatment bronchoscopy is of value in promoting drainage through the natural passages by keeping the bronchi open and thus facilitating postural drainage. Removal of granulation tissue also was often helpful. Patients in poor physical condition frequently were greatly improved by several bronchoscopic drainages, so that later surgical drainage could be carried out with less hazard.

The seriousness of pulmonary abscess emphasizes the need of prophylaxis, and this is considered by Bailey [10] as the best treatment. Patients should be prevented from aspirating infected materials during anesthesia or unconsciousness. In all cases in which evidence of pulmonary atelectasis from any cause is present, prompt investigation should be carried out, preferably by bronchoscopy, both for diagnosis and treatment to prevent serious pulmonary suppuration.

Once an abscess of the lung is fully formed, there are four lines of attack, namely, chemotherapy, supportive measures, drainage and pulmonary resection. Bronchoscopy is of value in diagnosis particularly to rule out neoplasm. If an abscess is fully formed when first seen, bronchoscopy, Bailey believes, should be done for diagnosis, as bronchial obstruction may be present, which would alter the plan of therapy. While there is a certain group of cases in which improvement will be noted after bronchoscopy, it is important that this procedure be not carried out for too long a period lest it contribute to the chronicity of the case.

While reports on pulmonary abscess occurring in children are few, suggesting that the condition may be uncommon, D'Ingianni [11] expresses

10. Bailey, C. P.: Lung Abscess and Its Treatment, Pennsylvania M. J. **48**: 799-805 (May) 1945.

11. D'Ingianni, V.: Nontuberculous Lung Abscesses in Children: Surgery of Sixty-Four Cases, J. Thoracic Surg. **14**:258-264 (June) 1945.

the opinion that this cannot be substantiated. In a series of 417 patients with abscess of the lung, 64, or 10.5 per cent, were children of 13 years or younger, and of these 29 per cent were children under 1 year of age. It was found that abscesses of the right lung were approximately twice as frequent as abscesses of the left and that the lower lobe was involved more frequently than the upper. The mortality rate was approximately the same irrespective of the side involved.

Opinions as to methods of treatment vary greatly. Sulfonamide compounds were used in 8 patients in this group, with 3 improved and 5 dead. Pneumothorax was attempted in 1 patient, without improvement. The treatment was primarily symptomatic, and only 3 patients were subjected to surgical treatment. References are made to the employment of postural drainage, bronchoscopy and bronchography, also the use of arsenicals in the treatment of the fusospirochetal type of abscess. The opinion is expressed that palliative forms of therapy are inadequate and that extirpation of the lesion seems the more feasible plan of therapy.

BRONCHIAL CONDITIONS AND PROCEDURES

Bronchiectasis.—While surgical excision of the affected portion of the lung is the most logical plan of therapy, it can be applied only when the disease is limited and does not involve more pulmonary tissue than can be safely removed. Levine [12] emphasized that medical treatment is needed for the majority of cases since the majority are not suitable for surgical procedures. Inadequate drainage and persistence of infection not only are necessary for the occurrence of the clinical entity bronchiectasis but also for its continuance and production of serious symptoms. Lesions of upper lobes and other types with adequate drainage seldom require much of any therapy. While bronchoscopy frequently is of value in helping to improve drainage, it seldom can reach the level where the pathologic changes really are. It has a definite place, however, in diagnosis as well as in treatment. The question of bronchial obstruction produced either by foreign body, new growth or other condition must always be taken into consideration.

Sulfonamide drugs and other chemotherapeutic agents are discussed. The results of their use, however, have been disappointing, owing to many factors, including chronicity of the lesion, insufficient blood supply and the difficulties encountered in getting the drug to the site of the infection.

Bronchoscopy in Diagnosis.—The early diagnosis of any disease of the chest is a matter of more importance to the physician today than

12. Levine, E. R.: The Treatment of Bronchiectasis, Dis. of Chest **11**:431-439 (Sept.-Oct.) 1945.

at any time in the history of medicine. In the opinion of Wilson,[13] early diagnosis, so essential to successful therapy, is being made in a minority rather than in a majority of patients with intrathoracic disease. Evidence points to failure to utilize modern methods of diagnosis.

Bronchoscopy has been perfected so that it can now be performed with only slight discomfort of the patient and with little risk. Any patient with a visible tumor or an unexplained density or suppuration of the lung, especially if in the middle or the older age group, should be suspected of having a pulmonary carcinoma. When such a lesion is discovered in the minimal or the asymptomatic stage, establishing the diagnosis is most urgent, because at this stage metastases and extension of the tumor are less likely to have occurred and surgical extirpation offers a greater chance of cure. Such patients should be given the benefit of bronchoscopy immediately, for 60 to 70 per cent of bronchial carcinomas originate in the major bronchi, and a biopsy specimen to establish the diagnosis can be obtained. All patients in whom biopsy has indicated a neoplasm should have the major bronchi explored at once, provided no clinical evidence of metastasis or extension of the tumor is present.

If the bronchoscope reveals nothing, a bronchogram should be made. This may demonstrate an obstructing lesion in one of the smaller bronchi, beyond the visual field of the bronchoscopist. A negative bronchogram, however, does not rule out a peripheral neoplasm. The bronchogram is of value only when it gives a positive result.

In discussing recent advances in bronchoscopic technic, Holinger[14] describes new equipment, new methods of anesthesia and new therapeutic procedures. In the field of anesthesia the use of curare has proved of great assistance in certain difficult cases. In the field of equipment outstanding are the retrograde bronchoscopic telescope for examination of upper lobes, smaller bronchoscopes for examination of the air passages of the newborn and equipment for bronchoscopic cinematography. Therapeutically the intrabronchial use of the sulfonamide compounds and penicillin has been of great value and has opened a new field of research.

Bronchospirometry.—While the total function of both lungs can be studied by spirometry, it is difficult to determine by this method alone the effective function of each lung. Bronchospirometry is a relatively recent method by which the functioning and the volume of each lung are determined separately at the same time. Pinner and his associates[15]

13. Wilson, N. J.: The Early Diagnosis of Diseases of the Chest, New England J. Med. **232**:301-309 (March 15) 1945.

14. Holinger, P. H.: Recent Advances in Bronchoscopic Technic, Dis. of Chest **11**:427-430 (Sept.-Oct.) 1945.

15. Pinner, M.; Leiner, G. C., and Zavod, W. A.: Bronchospirometry, Ann. Int. Med. **22**:704-718 (May) 1945.

employed a soft rubber catheter which made the method less uncomfortable for the patient, and the results more reliable. This method is indicated whenever an irreversible operation on one lung is contemplated, in order to determine the functional capacity of the contralateral lung. It also permits study of various physiopathologic problems. No serious complications were encountered in about 270 bronchospirometric examinations. The significance of the data obtained by this examination is discussed.

Bronchial Ciliary Action.—In experimental work previously carried out by Hilding [16] it was found that when cilia moved a mass of mucus sufficiently large to fill the lumen of an air passage, negative pressure developed behind the mass. The principle seemed to be that of piston-cylinder action. It was demonstrated repeatedly in the excised tracheas of freshly killed hens. He believed that this phenomenon might explain postoperative atelectasis. The question then arose, first, whether the negative pressure was due to absorption of air by the blood stream or to removal of air by ciliary action and, second, why if the negative pressure was due to ciliary action, it was insufficient in magnitude to account for the negative pressure found in atelectasis.

It was demonstrated that absorption played no role in the development of the negative pressure obtained in excised tracheas of hens, since on reversing the position of the trachea with reference to the manometer a positive pressure was recorded. In the earlier experiments the negative pressure obtained in the excised tracheas of hens did not exceed 55 mm. of water. In recent experiments a series of three or four tracheas from freshly killed hens were mounted in series, the ends being connected by means of rubber and glass connections. Mucus collected from the maxillary sinuses of patients was employed, and it was found that the effect produced on pressure by ciliary action was definitely cumulative when three or four tracheas were mounted in series. Each trachea added showed an increased pressure. In this series 9 of the 20 tracheas showed pressures above 55 mm. and 4 exceeded 100 mm., the highest pressure being 146 mm. Hilding concludes that the effect of ciliary action on occluding masses or pistons of mucus within a tube such as a hen's trachea is cumulative; that is, with several pistons of mucus being acted on by cilia the pressure is increased above that produced when there is only one. Each added piston increases the total pressure produced.

Chronic Stridor in Childhood.—Laryngeal stridor usually is ascribed to congenital maldevelopment of the larynx, particularly maldevelopment

16. Hilding, A. C.: Some Further Experiments in the Production of Negative Pressure in the Trachea and Frontal Sinus by Ciliary Action, Ann. Otol., Rhin. & Laryng. **54**:725-738 (Dec.) 1945.

above the superior orifice. Faber and his associates [17] reported 2 cases of persistent right aortic arch, discovered in early life, in which stridor was the presenting symptom and in which appropriate roentgenologic investigation established the diagnosis. Difficulty in swallowing is common and was present in both of these cases. More conspicuous is noisy breathing, accentuated during exertion or during feeding, which may at times be severe enough to cause retraction of the suprasternal notch, the thorax and the epigastrium, with cyanosis, and extreme extension of the head. During sleep the stridor tends to diminish or disappear.

In 1 case the diagnosis of congenital stridor of unknown cause was made. Several months later, increasing difficulties on the infant's part led to further studies, including laryngoscopy and esophagoscopy, and a diagnosis of persistent right aortic arch, right-sided descending thoracic aorta and anomalous retroesophageal subclavian artery was made. In the second case a diagnosis of persistent right aortic arch displacing the esophagus and the trachea anteriorly and to the left was made.

During life the diagnosis is entirely dependent on roentgenologic examination but, since special technics are required, cases will almost certainly be missed unless the clinician or the radiologist suspects and looks specifically for the anomaly. The most characteristic roentgenographic features are the anterior displacement of the esophagus at the level of the bifurcation of the trachea (lateral view) and the rounded filling defect of the esophagus, which in the anterior view is displaced to the left. Pulsations may also be seen by bronchoscopy or esophagoscopy and may be demonstrated by kymograms or angiograms. The authors conclude that in the presence of congenital or chronic stridor not due to obvious causes one should always consider and search for persistent right aortic arch. The diagnosis of enlarged thymus and "thymic stridor" based on a broad shadow in the upper mediastinum should not be accepted until persistent right aortic arch has been excluded.

In investigations of 236 patients who presented various bronchopulmonary infections, Meña Jeria [18] performed bronchoscopy for examination and treatment 483 times. In his report of results, brief reference is made to the instruments and the technic and to the indications and contraindications for bronchoscopy in nontuberculous bronchopulmonary disease.

In cases of pulmonary abscess bronchoscopy was employed as a diagnostic aid, also for purposes of treatment, but the author agrees

17. Faber, H. K.; Hope, J. W., and Robinson, F. L.: Chronic Stridor in Early Life Due to Persistent Right Aortic Arch.: Report of Two Cases, J. Pediat. **26**:128-137 (Feb.) 1945.

18. Meña Jeria, R.: Bronchoscopy: Its Application in Diagnosis and Treatment of Bronchopulmonary Infections, Rev. de otorrinolaring. **5**:122-151 (Sept.) 1945.

that the best results are secured by combined medical and surgical treatment. In cases of bronchiectasis, bronchoscopic aspiration may be employed as a palliative procedure if surgical treatment cannot be carried out. In the field of bronchial neoplasm, early recognition and biopsy, if possible, are imperative for successful surgical treatment. In a discussion of hemoptysis the author reports 2 cases of varicosities of the trachea, a rare condition. These were treated by cauterization, which was carried out bronchoscopically. Illustrative cases are cited under the various headings.

Acute Laryngotracheobronchitis.—Since acute laryngotracheobronchitis is not a specific entity but a clinical syndrome produced by a combination of factors, it is difficult to plan any specific therapy. The most important pathologic changes encountered are mucosal and submucosal inflammatory edema involving the larynx and the lower respiratory tract. The most urgent early symptoms therefore are those produced by the presence of edematous, swollen subglottic mucosa, namely, respiratory obstruction. It probably is primarily influenzal in origin, with secondary invaders, more often streptococci, complicating the clinical picture. The only highly effective specific therapeutic agent now available is human convalescent serum, primarily anti-influenzal and secondarily antistreptococcic. With these the disease may be shortened and the development of complications avoided. Baum [19] recommends a dose of 50 to 250 cc. of serum, depending on the size of the patient and other factors, preferably given intravenously, although the intramuscular or the subcutaneous route may be used. Immune blood may be transfused as a substitute when available.

Management of subglottic edema becomes of paramount importance when there is dyspnea. Intravenous use of concentrated human plasma may solve the problem, and tracheotomy may be avoided. The osmotic action of the hypertonic plasma protein withdraws the fluid of edema from the interstitial spaces of the subglottic tissues and the tracheobronchial tree into the blood stream. Avoidance of laryngeal obstruction and tracheotomy also avoids serious sequelae, notably tracheobronchial crusting with obstruction. This in turn contributes enormously to shortening the convalescene. In cases in which edema develops in spite of therapy, tracheotomy or intubation may become necessary. While Baum believes that intubation is the operation of choice, especially early, a combination of both intubation and tracheotomy may frequently be of advantage to minimize tracheobronchial dryness. Humidification of the inspired air is important in the prevention of dryness of the tracheobronchial mucosa and formation of crusts.

19. Baum, H. L.: Treatment of Acute Laryngotracheobronchitis, Arch. Otolaryng. **41**:175-181 (March) 1945.

While penicillin has been tried in but few instances it probably would be of little value if the primary invader should be a virus; however, it has been used successfully to combat secondary infection. It also has been reported as acting favorably when instilled into the tracheotomic cannula.

Ulcerative Tracheobronchitis.—The persistence of symptoms and the development of certain complications and sequelae following atypical pneumonia have led to the belief that this condition is not as innocuous as previously described. In 29 patients who were examined bronchoscopically, Kay [20] found ulcerated lesions of the tracheobronchial tree.

Bronchoscopic examination of patients with ulcerative tracheobronchitis following atypical pneumonia revealed the mucous membrane of the trachea and the bronchi to be inflamed and irritated. When the inflammation was acute, the mucosa was readily traumatized with the tip of the bronchoscope. Ulcerations usually were multiple and bilateral. The posterior and posterolateral walls commonly were involved. The ulcers appeared ragged and hyperplastic, often covered with a thin, grayish yellow membrane suggesting tuberculous ulceration. The ulceration tends to remain chronic, being resistant to therapy, and may be associated with scarring and cicatrization giving rise to stenosis. Topical applications of a 30 per cent solution of silver nitrate were made, but healing usually required from two to four months.

Four reports of cases characteristic of the group which illustrate various clinical, roentgenologic and bronchoscopic aspects of this disease are presented.

Broncholithiasis.—In a report of 10 cases of broncholithiasis, Fox and Clerf [21] emphasize the importance of considering this condition in the differential diagnosis of bronchial obstruction.

Productive cough, hemoptysis, substernal pain and expectoration of a concretion were the salient clinical findings. In the early stages the cough was characteristically paroxysmal, dry and hacking, being worse at night when the patient assumed a prone posture. Later when bronchial obstruction developed, with suppuration and atelectasis, the cough became productive. Hemoptysis was common, but in no instance was it sufficiently severe to warrant blood transfusion. Although a concretion may have been expectorated, one should not assume that all have been evacuated, for in 5 instances, after spontaneous expectoration of a broncholith, additional concretions were removed bronchoscopically. The middle lobe was the one most frequently involved, being the seat of concretions in 5 cases. The lower lobe of the right lung was involved in 3

20. Kay, E. B.: Ulcerative Tracheobronchitis Following Atypical Pneumonia: Report of Cases, Arch. Int. Med. **76**:93-101 (Aug.) 1945.

21. Fox, J. R., and Clerf, L. H.: Broncholithiasis: A Report of Ten Cases, Ann. Int. Med. **23**:955-959 (Dec.) 1945.

instances and the upper and the lower lobe of the left lung in 1 case each. As in practically all forms of bronchial obstruction if long continued, residual cylindric bronchiectasis was the most common complication.

Bronchography.—The use of iodized oil as a contrast medium in lung mapping is now generally accepted as an important diagnostic aid. In discussing this subject, McReynolds and Shelton [22] emphasize that it is as important to use bronchography to rule out bronchopulmonary lesions as it is to use it to establish their presence. It also is important to employ it to outline the supposedly normal portions of the lungs in a patient with a pathologic condition before deciding on the plan of treatment to be undertaken. Bronchography should not be considered as a substitute for bronchoscopy but as an adjunct, and in practically all cases diagnostic bronchoscopy should precede the instillation of iodized oil.

TRACHEOBRONCHIAL NEOPLASMS

Neoplasm of the Trachea.—Tumors of the trachea occur infrequently, and there has not been observed a proportionate increase when their incidence is compared with that of bronchogenic neoplasms. In reviewing a series of 27 cases of neoplasm of the trachea, Tinney and his associates [23] emphasize the importance of early recognition. As a rule, the lesions are far advanced before a correct diagnosis is made, and the prognosis therefore is poor. The most frequent and most important symptom observed was the dyspnea produced when the tumor encroached on the lumen of the trachea, producing obstruction. It was observed in 24 cases (89 per cent) and was the initial symptom in 22 (81 per cent). Cough was observed in 15 cases (56 per cent).

The best therapeutic results were secured in cases of cylindroma. This was treated by irradiation, either radium or roentgen rays being used, without or with diathermy. Carcinoma offered an extremely difficult therapeutic problem, and no one form of treatment was found satisfactory. If situated in the upper portion of the trachea, the carcinoma was best handled by means of tracheal fissure and diathermic destruction of the tumor. Carcinoma of the lower end of the trachea was best treated by diathermy through the bronchoscope. Implantation of radon, although employed, probably was of questionable value.

In most cases death is caused by tracheal obstruction, hemorrhage or secondary pulmonary suppuration.

Adenoma of the Trachea.—Adenoma arising from the cervical portion of the trachea is rare. Harrill [24] reports one occurring in a man aged 35

22. McReynolds, G. S., and Shelton, F. W.: Bronchography as a Diagnostic Aid in Chest Disease, Ann. Otol., Rhin. & Laryng. **54**:114-124 (March) 1945.

23. Tinney, W. S.; Moersch, H. J., and McDonald, J. R.: Tumors of the Trachea, Arch. Otolaryng. **41**:284-290 (April) 1945.

(Footnotes continued on next page)

years, who had sustained an injury to the side of the neck. Following this, certain symptoms developed which did not completely clear up, and when admitted to the hospital the patient had definite respiratory distress with some cyanosis, enlargement of the neck, with a very firm thyroid gland that was palpable bilaterally, hoarseness, dysphagia and an infection of the upper respiratory tract.

Laryngoscopic examination revealed fixation of the left vocal cord and the presence of a rounded reddish mass in the upper part of the trachea. The mass was ultimately removed, following tracheotomy, and measured 1 by 1 cm. The histologic diagnosis was adenoma. On 2 occasions a small solitary recurrence was observed, which was readily removed with laryngeal cupped forceps.

The case is of interest because of the location of the tumor, the question of its being traumatic in origin and the occurrence of dyspnea, wheezing and stridor.

In the opinion of Graham and Womack [25] the so-called bronchial adenoma must be regarded as a potentially malignant tumor. Although it may pursue a nonmalignant course for many years, there always remains the possibility that cancerous processes, such as invasion of neighboring structures, involvement of regional lymph nodes and development of distant metastases, may occur.

Evidence of the potential malignancy of these tumors is supported by a case cited by the authors.

The frequent inability to determine from a biopsy specimen whether the tumor has already become cancerous makes attempts to remove the local growth through the bronchoscope unwise and dangerous. They express the opinion that total pneumonectomy is the procedure of choice.

In a report on 38 consecutive cases of bronchial adenoma Moersch and his associates [26] state that 22 (57.9 per cent) of the patients were women. The average age of the patients was 37 years.

Cough was the most frequent symptom, occurring in 85 per cent of the cases. It was not productive in the earlier stages of the disease, but as atelectasis with secondary infection occurred there was sputum. In 46 per cent of the cases there was a history of one or more attacks of acute pulmonary infection, and in many instances the first evidence of an endobronchial lesion was an acute febrile episode, usually diagnosed as pneumonia. Wheezing was a prominent symptom in 23 per cent of the cases and was the initial symptom in 14 per cent.

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24. Harrill, J. A.: Adenoma of the Trachea, Arch. Otolaryng. **41**:74-76 (Jan.) 1945.

25. Graham, E. A., and Womack, N. A.: The Problem of the So-Called Bronchial Adenoma, J. Thoracic. Surg. **14**:106-119 (April) 1945.

26. Moersch, H. J.; Tinney, W. S., and McDonald, J. P.: Adenoma of the Bronchus, Surg., Gynec. & Obst. **81**:551-558 (Nov.) 1945.

The bronchoscopic appearances were usually typical, so that one frequently was able to make a diagnosis from the appearances alone. Ulceration was rare, but slight contact with the bronchoscope often precipitated marked bleeding.

A final diagnosis must of course depend on histologic examination. The microscopic picture is quite characteristic. In no instance in their series did the adenoma metastasize to the other lung or outside the thoracic cavity.

The method of treatment to be employed depended on the situation of the tumor, the extent of pulmonary suppuration and the patient's general condition. In their experience endoscopic destruction of the tumor and surgical extirpation by lobectomy or pneumonectomy have proved the most satisfactory plans of treatment.

Reviewing the records of cases of bronchial tumor, Jackson and his associates [27] found that 20 were considered typical of the clinical and pathologic entity known as benign adenoma of the bronchus. Sixteen, or 80 per cent, of the patients were women. An attempt is made to standardize the histopathologic diagnosis of this type of tumor, and the differential diagnosis between adenoma and low grade adenocarcinoma and other tumors is considered. They do not believe that adenoma has any inherent tendencies to metastasize or in any other way become malignant. None of their patients showed such a course, although a number had been under observation for ten years or longer. Three of the series were treated by lobectomy or pneumonectomy. The remaining 17 were treated by bronchoscopic measures, including removal with forceps and electrocoagulation. In cases in which there is atelectasis or bronchiectasis a preoperative course of bronchoscopic treatments seemed indicated even if pulmonary resection had been decided on or was to be considered at a later date.

In a report covering 10 cases of adenoma Chamberlain and Gordon [28] discuss methods of treatment. They consider pulmonary resection as preferable, since it offers a definitive cure, the hazards associated with damage of the lung distal to the tumor are avoided and some of these tumors are thought to be potentially malignant and occasionally metastasize. They believe that endobronchial removal is indicated in some cases, namely those in which the surgical risks are not reasonably good, those in which the trachea is involved, those with abscess distal to the tumor, in which the patient is best prepared for subsequent resection of the tumor through improvement of bronchial drainage,

27. Jackson, C. L.; Konzelman, F. W., and Norris, C. M.: Bronchial Adenoma, J. Thoracic Surg. **14**:98-105 (April) 1945.

28. Chamberlain, J. M., and Gordon, J.: Bronchial Adenoma Treated by Pulmonary Resection: Case Reports, J. Thoracic Surg. **14**:144-152 (April) 1945.

and the rare one in which the tumor is entirely within the bronchus, attached by a long slender pedicle, and easily accessible.

Cylindroma of Bronchus.—Cylindroma of the bronchus, a neoplasm which is remarkably similar to adenoma, is discussed by McDonald and his associates [29] in a report covering 6 cases. These constituted 10 per cent of the cases of bronchial neoplasm belonging to the adenoma and cylindroma groups. One of the differences is that cylindroma often involves the trachea, whereas adenoma rarely involves this structure. The gross appearance is similar to that of adenoma. The tumor, which almost invariably arises from a large bronchus, forms a polyp projecting into the bronchial tree.

Histologically there is a definite similarity to adenoma in that the cells comprising the neoplasm are small, regular and often hyperchromatic. The overlying mucosa commonly is intact. The main point differentiating cylindroma from adenoma is a secretion apparently being produced by the epithelial cells.

No characteristic symptoms are observed. The symptoms depend generally on the situation and the size of the tumor. Cough is the earliest symptom; it usually is dry and nonproductive until there is obstruction of the bronchus with retention of secretion and suppuration.

Bronchogenic Carcinoma.—In an excellent study of bronchogenic carcinoma, Holinger and his associates [30] analyzed 175 cases from the etiologic standpoint and discussed age, sex and race distribution, symptoms, pathologic observations, diagnosis and treatment. While no definite group of symptoms can be said to be diagnostic, the most significant was cough, which occurred in 87 per cent of the patients. The onset of the cough usually was early in the disease and remained throughout the clinical course. It was commonly progressive and failed to respond to rest or medication. Thoracic pain was recorded on admission for 59 per cent. Dyspnea was observed in 55 per cent. In 136 cases bronchoscopic biopsy specimens demonstrated neoplastic growth, a rate of 78 per cent.

Bronchoscopic procedures as a means of treatment of patients whose lesions otherwise were inoperable, also endobronchial implantation of radium, are discussed. The plan of therapy obviously must be surgical extirpation in every case in which it is possible. Only those in which a resort to operation cannot be made are suitable for some other plan of therapy.

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29. McDonald, J. R.; Moersch, H. J., and Tinney, W. S.: Cylindroma of the Bronchus: A Report of Six Cases, J. Thoracic Surg. **14**:445-453 (Dec.) 1945.

30. Holinger, P. H.; Hara, H. J., and Hirsch, E. F.: Bronchogenic Carcinoma: An Analysis of One Hundred Seventy-Five Proved Cases, Ann. Otol., Rhin. & Laryng. **54**:5-36 (March) 1945.

In a discussion of primary carcinoma of the bronchus, Ochsner and his associates [31] emphasize the importance of bronchoscopy in diagnosis. In their opinion bronchoscopy is not performed often enough in cases in which carcinoma is suspected. Too often the lesions are so situated that they cannot be visualized bronchoscopically, and a biopsy specimen cannot be secured.

Bronchography also is a valuable diagnostic aid, particularly in cases in which a mass does not cast a shadow and in cases in which the lesion is in a bronchus but cannot be visualized bronchoscopically.

The article is a valuable contribution to the literature on bronchogenic carcinoma, and there is an excellent bibliography appended.

In a discussion of bronchogenic carcinoma, Bloch and his associates [32] point out certain of the difficulties encountered in diagnosis. Through routine roentgen examinations and other diagnostic procedures carcinoma is found in appreciable numbers, in early as well as in advanced stages. In cases in which it is in an early stage a differential diagnosis frequently is difficult and often cannot be established by conservative methods, so that surgical exploration may be required. While a roentgen examination is helpful, it often can never establish a definite differential diagnosis. Emphasis is placed on the serial roentgenologic demonstration of the development of carcinoma from its very beginnings. A number of cases are described which illustrate the diagnostic difficulties.

Because of many clinical and roentgenologic similarities, the differentiation between bronchial carcinoma and pulmonary tuberculosis offers certain difficulties. In connection with an analysis of 12 cases ultimately proved to be cases of carcinoma in which the patients had been admitted to a hospital for the tuberculous, Pillsbury and Wassersug [33] emphasize the frequent similarity between these conditions. They stress the importance of prompt diagnosis, especially in cases of carcinoma, and the importance of diagnostic bronchoscopy if the roentgenographic findings are not characteristic of tuberculosis and several examinations of sputum reveal no tubercle bacilli.

TUBERCULOUS TRACHEOBRONCHITIS

Bronchoscopy in Tuberculosis.—The frequent occurrence and serious implications of tuberculous tracheobronchitis, particularly when col-

31. Ochsner, A.; Dixon, J. L., and DeBakey, M.: Primary Bronchogenic Carcinoma, Dis. of Chest **11**:97-129 (March-April) 1945.

32. Bloch, R. G.; Adams, W. E.; Thornton, T. S., and Bryant, J. E.: Difficulties in the Differential Diagnosis of Bronchogenic Carcinoma, J. Thoracic Surg. **14**:83-97 (April) 1945.

33. Pillsbury, N. R., and Wassersug, J. D.: The Differentiation of Bronchogenic Carcinoma and Pulmonary Tuberculosis, New England J. Med. **232**:276-278 (March 9) 1945.

lapse therapy is contemplated, emphasized the need for bronchoscopic investigation in cases of tuberculosis, particularly if indications are present. While this involvement probably is not generally recognized, there is an ever increasing number of patients being examined, and in some institutions routine bronchoscopy is performed on every patient admitted.

In a discussion of tuberculous tracheobronchitis, Wilson [34] divides the indications for bronchoscopy into clinical and roentgenologic and considers them under these headings. The clinical and the roentgen evidences of tuberculous bronchitis are based on the fact that in many of these cases there is narrowing of the bronchus with retention of secretion, and if these signs and symptoms are used as a guide in selecting patients, a high incidence of bronchial lesions will be discovered. Among the contraindications are pulmonary hemorrhage, acute infection of the respiratory tract and tuberculous laryngitis. The latter is considered an absolute contraindication except in cases of extreme emergency, such as bronchial occlusion following thoracoplasty.

The matter of local therapy has been a debatable point. Wilson employed a local application of a 30 per cent solution of silver nitrate at intervals of two weeks, treatment being instituted as early as possible. He has never seen stenosis result from the application of a solution of this strength and agrees with many authors that any resulting fibrosis in the bronchus is the end result of the destruction of the bronchial structures by the tuberculous process itself and not of the use of silver nitrate. Local therapy is employed only for areas of ulceration and granulation tissue. No attempt is made to treat fibrous stenosis. In his experience no method of therapy will effect any permanent dilatation. Temporary relief, however, may be secured by dilation of the bronchi and aspiration of the retained secretions. In the cases in which the lesions responded well, treatment was continued at intervals of two weeks until all evidence of activity had disappeared, but repeated examinations were performed for at least six months to determine any early recurrence.

In a study of 279 patients with pulmonary tuberculosis, Tapia Acuña [35] found tuberculous lesions in 83, or 29.7 per cent of the total group. This was not considered excessive when it was taken into consideration that bronchoscopy was performed because tracheobronchial lesions were suspected. Granulomatous lesions were found in 52 cases. The left bronchus was involved in 46 instances (55.4 per cent). The

34. Wilson, N. J.: Bronchoscopic Observations in Tuberculous Tracheobronchitis; Clinical and Pathological Correlation, Dis. of Chest **11**:36-59 (Jan.-Feb.) 1945.

35. Tapía Acuña, R.: Bronchoscopy in Pulmonary Tuberculosis, Dis. of Chest **11**:392-397 (Sept.-Oct.) 1945.

frequency of lesions of the left bronchus suggested that infection results from prolonged contact of the mucosa with purulent secretions, since drainage is less effective on the left side.

Different forms of local treatment were employed. Diathermy did not seem to give satisfactory results. Applications of 10 to 30 per cent solutions of silver nitrate, and in 1 instance a 50 per cent solution, were successful. The writer is agreed that bronchoscopy is of great aid to the phthisiologist and the thoracic surgeon. It has many advantages, and in his experience it did not constitute a danger in cases of tuberculosis, there being no mortality observed which could be attributed to the introduction of the endoscopic tube or to manipulation of the tracheobronchial tree.

Menendez and his associates [36] found tuberculous tracheobronchitis in 20 to 25 per cent of patients with pulmonary tuberculosis. It was found more often in women, particularly in those between 20 and 30 years of age. The early recognition of tracheobronchial lesions is emphasized, for treatment then can be promptly instituted and certain of the end results, namely, cicatricial stenosis, may be avoided. In their experience the fibrostenotic forms gave a mortality rate of approximately 50 per cent.

While there are certain clinical symptoms and roentgenologic signs, these are not sufficiently positive to permit of a diagnosis without bronchoscopic corroboration. In their experience no complications attributable to bronchoscopy have been observed. They believe, however, that biopsy is contraindicated in tuberculous lesions.

Certain of the indications for bronchoscopic investigation are discussed. Emphasis is placed on the occurrence of symptoms which suggest asthma. These invariably denoted the presence of a tracheobronchial lesion. Certain patients with tuberculosis, however, may be allergic. Before considering such a patient as asthmatic, bronchoscopic investigation is definitely indicated.

Local treatment with a solution of silver nitrate was considered the most effective plan for the acute stages of the tracheobronchial lesions. In the presence of bronchial stenosis pneumothorax proved ineffective in many instances and at times was dangerous, so that a permanent type of collapse was probably preferable.

Bell and Schaff [37] agree that roentgenographic findings suggesting tuberculous tracheobronchitis definitely indicate the need for bronchoscopic investigation.

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36. Menendez, F. J.; Hernandez Gonzalo, P., and Fernandez Ponjoan, E.: Tuberculous Tracheobronchitis: A Clinical and Bronchologic Study, Rev. mex. de tuberc. **7**:140-160 (May-June) 1945.

37. Bell, F. G., and Schaff, B.: Bronchoscopy in Pulmonary Tuberculosis, J. Missouri M. A. **42**:549-551 (Sept.) 1945.

While about 80 per cent of the tracheobronchial lesions will heal if the parenchymal disease is controlled, additional therapy will be required for about 20 per cent. They applied a 30 per cent silver nitrate solution to the lesions about every two weeks. They believe that bronchoscopic examination should be repeated monthly until healing is assured.

Untoward Effects Following Bronchoscopy.—Although medical literature contains many reports on bronchoscopy as employed in the diagnosis and the treatment of pulmonary diseases, it contains few that deal with the untoward effects of this procedure. Titche [38] reports on a series of 361 bronchoscopic procedures performed on 214 patients, a majority of whom had pulmonary tuberculosis. Of 245 bronchoscopies performed on 147 patients with pulmonary tuberculosis, 103 were followed by a febrile reaction during the first week and 22 by a second rise of temperature after this time. In 4 patients of the group showing the second rise of temperature roentgen examination revealed an extension of the tuberculous process. Of the 116 bronchoscopies that were performed on 67 patients with nontuberculous pulmonary conditions, 37 were followed by a rise in temperature during the first week and 2 by a second rise later.

The initial rise in temperature probably could be explained in the majority of instances by the trauma of instrumentation, and this appeared to be borne out by the similarity of the reactions in the tuberculous and the nontuberculous patients. The second rise was particularly important in tuberculous patients and appeared to be an indication either of a spread of the disease or of further activation of it.

The only suggestions offered to prevent further occurrences of this type are the following: A more careful selection of patients should be made for bronchoscopy. The procedure should be carried out with a minimum of trauma. Patients should be encouraged to clear the tracheobronchial tree of secretions as soon as possible after bronchoscopy. Since the disturbance of the cough reflex caused by the anesthetic may be a factor, it is recommended that the minimal quantity necessary for the procedure be employed.

While the common complications of bronchoscopy are well known, and the one commonly considered is subglottic edema, little attention has been directed to the association of pneumothorax as a bronchoscopic hazard. Abbott and De Oliveira [39] direct attention to the occurrence of pneumothorax following diagnostic peroral endoscopic examination performed without the use of forceps or other instruments by which

38. Titche, L. L.: Postbronchoscopic Reactions, Ann. Otol., Rhin. & Laryng. **54**:568-574 (Sept.) 1945.

39. Abbott, O. A., and De Oliveira, H. R.: Spontaneous Pneumothoraces Occurring in Patients Undergoing Peroral Endoscopy, J. Thoracic Surg. **14**:453-460 (Dec.) 1945.

trauma to a bronchial wall might be produced. In 2 cases the pneumothorax was asymptomatic and was discovered accidentally by fluoroscopic examination; in both cases it was associated with suppurative disease of the lung, but no evidence of empyema occurred. In the third and fourth cases there was considerable evidence of bronchopulmonary disease, so that changes in the periphery of the lung were likely and, if associated with paroxysms of coughing, may have been responsible for the pneumothorax. The authors believe that pneumothorax would be a more commonly recognized condition attendant on bronchoscopy if more frequent use of the fluoroscope occurred in conjunction with bronchoscopic procedures.

DISEASES OF THE ESOPHAGUS

Stricture of the Esophagus.—Benign cicatricial stenosis of the esophagus usually is the result of injury caused by the ingestion of household lye. Small children more often are the patients, although adults occasionally ingest it by mistake. In discussing the treatment, McHenry and Clay [40] emphasized that first aid measures usually cannot be applied early enough, as the injury occurs almost immediately on contact of the lye with the mucosa.

Treatment must be directed first toward preserving the life of the patient and secondly toward maintaining his general state of health so that the lesion will heal and then maintaining a patent esophageal lumen with restoration to a size compatible with relatively normal esophageal function. They emphasize the importance of persuading patients to swallow a thread, this to be left in place, so that dilation by other methods can be pursued later. They advocate early gastrostomy when the patient cannot or will not swallow a thread. This permits of early feeding and the maintenance of a favorable state of nutrition. Placing the esophagus at rest allows earlier and more prompt healing of the local lesions. It also enables carrying out the most effective and the least dangerous method of dilation, namely, the retrograde method.

The records of 52 patients with burns of the esophagus were studied. Over half of the patients were 3 years of age or younger. Gastrostomy was performed in 38; in 31 treatment was by peroral bougienage only. Seventeen patients were treated by retrograde bougienage. While the treatments were carried out over long periods, the average of the series was slightly more than forty months. The longest period of treatment was eleven years. Eight patients (15.3 per cent) died of bougienage perforation of the esophagus. In 4 of these the esophagus was perforated on the first attempt to get a bougie through. It is believed

40. McHenry, L. C., and Clay, R. A.: Benign Esophageal Strictures, J. Oklahoma M. A. **38**:469-474 (Nov.) 1945.

that a portion of this mortality might have been prevented if gastrostomy had been done earlier and no attempt had been made to dilate the esophagus until healing of the ulcers had taken place.

Benign Tumors of the Esophagus.—The symptoms of all esophageal lesions are so similar that they usually afford little differential diagnostic information. In their study of benign tumors of the esophagus, Adams and Hoover [41] found no helpful physical signs. Roentgenologic study with barium sulfate, however, brought out certain characteristic features. Esophagoscopic findings often are of little value, particularly if the tumor is intramural. Since these usually are covered by intact mucosa, a biopsy not only would give no information but would be contraindicated, particularly if surgical removal was shortly to be contemplated.

In 1 case, an esophageal polyp which was pedunculated, being 6.5 cm. in length and having its origin at the cricopharyngeus muscle, was removed esophagoscopically with the aid of a snare and diathermy. The patient made a satisfactory recovery.

Dilatation of the Esophagus.—Idiopathic dilatation of the esophagus is relatively common. Although most commonly designated as achalasia of the cardia or as cardiospasm, there are widely conflicting opinions about the cause. While dilating the cardia affords relief in a majority of the cases, some conditions do not respond satisfactorily to this or other conservative methods of treatment. Scott [42] made certain observations that to him clarified the mechanism involved and enabled him to show important physiologic and probably etiologic differences and to attack the difficult therapeutic problem.

In an analysis of 85 cases he was able to recognize four clinical types, which probably also differ from one another in their etiologic factors. They are achalasia, true cardiospasm, dilatation associated with a constriction at or just above the cardia and dolichoesophagus.

In the small group of cases in which the condition is intractable and dilation and other conservative methods of therapy do not help, operative treatment is indicated.

Four types of pulmonary change shown roentgenographically as occurring in patients with cardiospasm have been reported as follows, basal pneumonitis, pulmonary abscess, bronchiectasis and pleural effusion. To these Hawes and Soule [43] have added a fifth, namely, pulmonary fibrosis.

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41. Adams, R., and Hoover, W. B.: Benign Tumors of the Esophagus: Report of Three Cases, J. Thoracic Surg. **14**:279-286 (Aug.) 1945.

42. Scott, W. J. M.: Idiopathic Dilatation of the Esophagus: Differentiation of Clinical Types and Successful Operation in Intractable Cases, Ann. Surg. **122**: 582-605 (Oct.) 1945.

43. Hawes, L. E., and Soule, A. B.: Pulmonary Changes in Cardiospasm, Am. J. Roentgenol. **53**:124-128 (Feb.) 1945.

Patients with cardiospasm are commonly troubled with cough and occasionally by sudden paroxysms of strangulation when lying down or while asleep, due to overflow of secretions regurgitated into the pharynx. Treatment of the primary condition promptly relieves the pulmonary complications. Two illustrative cases are reported.

Cardioesophageal relaxation or insufficiency of the cardia is an abnormality of unknown cause in which gastric contents regurgitate passively into the esophagus through a patent cardiac sphincter. This probably is not a clinical entity, having been observed in combination with other pathologic lesions. In the case reported by Berk [44] there was a history of "stomach trouble" for over twenty-five years. Many studies were carried out, with negative results, and it was only after a study of the esophagus to determine the presence of hiatal hernia that relaxation of the cardioesophageal junction was suspected. This was corroborated by esophagoscopy. Recognition of cardioesophageal relaxation is important because it may be confused with hiatal hernia, achalasia, cancer and other conditions. It can be diagnosed by fluoroscopy with the patient in the supine or Trendelenburg position, when barium sulfate may be seen to flow passively into the lower part of the esophagus.

FOREIGN BODIES IN THE ESOPHAGUS

Esophageal Obstruction.—Richardson [45] carried out experimental studies with a proprietary proteolytic enzyme obtained from the fruit of the papaw ("Caroid"), to determine its ability to digest meat and employed it in the treatment of obstruction of the esophagus due to impaction of meat. He reported his results in 17 cases. This preparation, which is a powder, was employed first alone. Later it was used dissolved in glycerin, then used with lactose and finally the author found that a 5 per cent solution of papain dissolved in a 10 per cent alcoholic vehicle was most satisfactory. The ability of this enzyme to digest meat was not impaired, and a stock solution can be made which may be kept for many weeks.

Before administering this preparation a roentgen study was made to confirm the diagnosis, to rule out the presence of bone and to determine the exact location of the foreign body. Fluoroscopy with and sometimes without employment of a barium sulfate mixture gave the desired information. The patient then was given small quantities of the solution, depending on his ability to swallow. One or two cubic centimeters administered every fifteen minutes usually yielded excellent

44. Berk, M.: Cardio-Esophageal Relaxation, Gastroenterology **5**:290-298 (Oct.) 1945.

45. Richardson, J. R.: A New Treatment for Esophageal Obstruction Due to Meat Impaction, Ann. Otol., Rhin. & Laryng. **54**:328-348 (June) 1945.

results. A majority of the patients with esophageal obstruction were relieved within an hour and a half. In 16 of the 17 patients prompt relief was secured. In the remaining patient it was necessary to remove the foreign body instrumentally, as the patient was unable to retain the solution in the esophagus.

Magnetic Removal of Foreign Body.—A magnet to aid in removing magnetizable metallic substances both from the air and from the food passages is described by Equen.[46] The magnet used in the tracheobronchial tree is cylindric and is attached to a ureteral catheter which may be passed through the bronchoscope under fluoroscopic guidance. When the magnet is to be used in the esophagus and the stomach it is attached to a tube which permits inflation of the stomach when desired. Unfortunately, many of the foreign bodies are not magnetizable and the field of usefulness of a magnet is therefore somewhat restricted. In spite of this, however, it has a definite field in the removal of foreign bodies.

In the retrograde method of treatment of esophageal stricture, often the most difficult single technical problem is the first insertion of the thread. Equen [47] reports a new procedure which simplified the problem, with no sacrifice at stake. He employed a minute cone-shaped steel dilator and a magnet. As the dilator was passed gently through the esophagus into the stomach, the end was located with the aid of the magnet, passed through the gastrostomy opening, and both were withdrawn through this opening. The string was then attached to the dilator and both were pulled up through the esophagus.

Maness [48] reports the occurrence of mediastinal and subcutaneous emphysema in a boy aged 7 years, who had aspirated a peanut four days previously. There was roentgen evidence of emphysema involving the base of the right lung. Air was present in the mediastinum and in the soft tissues of the neck, and there was bilateral pneumothorax.

The patient made a satisfactory recovery after bronchoscopic removal of the peanut.

GASTROSCOPY

In a study which involved 1,132 patients, who were examined one or more times gastroscopically and roentgenologically by Dr. Hardt and his associates,[49] these methods were compared in regard to the infor-

46. Equen, M.: The Alnico Magnet: An Aid to Bronchoscopy and Esophagoscopy, Ann. Otol., Rhin. & Laryng. **54**:178-182 (March) 1945.

47. Equen, M.: Magnetic Aids in Inserting an Esophageal String, Arch. Otolaryng. **42**:419-420 (Nov.-Dec.) 1945.

48. Maness, G. M.: Mediastinal and Subcutaneous Emphysema of Foreign Body Origin, Laryngoscope **55**:706-707 (Dec.) 1945.

49. Hardt, L. L.; Hufford, A. R., and Rabens, J. I.: Analytical Survey of 1,132 Patients Gastroscopically Examined, Gastroenterology **4**:477-483 (June) 1945.

mation provided. The findings demonstrated conclusively that gastroscopy should be done before a diagnosis of normalcy is made, for experience indicated that gastroscopy is the most important aid in making a negative gastric diagnosis and in diagnosing all types of gastritis.

In their experience the gastroscopist was correct in 89 per cent of all types of benign ulcerated lesions and the radiologist in 58 per cent. The gastroscope also was more accurate in following healing of an ulcer, in localizing the lesion and in detecting changes suggesting a cancerous character. Gastric cancer was recognized gastroscopically in 94 per cent of cases and roentgenologically in 79 per cent; with combination of both methods the lesions were detected in 98 per cent of cases. Gastroscopic diagnosis was incomplete in 5 per cent, and then the diagnosis had to rest entirely on the roentgen findings.

In a group of 150 cases of chronic seasickness studied clinically by Benedict and Schwab [50] it was found that characteristic roentgenologic appearances were presented in 50 per cent. Constant findings were hypersecretion, loss of gastric motility and spasm of the pylorus. In some, thickened gastric rugae were observed. The gastroscopic findings were essentially normal.

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50. Benedict, E. B., and Schwab, R. S.: Gastroscopic Studies in Naval Personnel with Chronic Seasickness, New England J. Med. **233**:237-238 (Aug. 23) 1945.

News and Comment

MEETINGS

The following meetings will be held in St. Louis:

American Board of Otolaryngology, Hotel Coronado, April 15 to 20.
American Otological Society, Inc., Hotel Statler, April 21 to 22.
American Laryngological Association, Hotel Statler, April 23 to 24.
Triological Society, Hotel Statler, April 25 to 26.

The annual meeting of the American Broncho-Esophagological Association will be held at the Hotel Brighton, Atlantic City, N. J., June 9.

Because of the exceptionally heavy demand for guest rooms, it is necessary to make reservations as far in advance as possible.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

The eighth annual spring postgraduate course in ophthalmology and otolaryngology will be held in Portland, Ore., April 7 to 12, 1947. The Oregon Academy of Ophthalmology and Otolaryngology and the University of Oregon Medical School have arranged a program and Dr. John Dunnington, professor of ophthalmology at Columbia University, New York, and Dr. George Shambaugh Jr., professor of otolaryngology at Northwestern University, Chicago, will be the speakers. There will be lectures, clinical demonstrations and ward rounds. Preliminary programs will be available about March 1. Additional information may be procured from Dr. Harold M. U'Ren, secretary, 1735 North Wheeler Avenue, Portland 12, Ore.

GRADUATE COURSE IN OTORHINOLARYNGOLOGY AND BRONCHOSCOPY

The Georgetown University Medical Center is sponsoring an intensive graduate course in otorhinolaryngology and bronchoscopy by Prof. Georges Portmann, of the University of Bordeaux, France, April 7 to 21, 1947 in Georgetown University School of Medicine, Washington, D. C.

Further information concerning this graduate course may be had by writing to Dr. James A. Flynn, 1511 Rhode Island Avenue, N. W., Washington, D. C.

Abstracts from Current Literature

Ear

SECRETORY OTITIS MEDIA. WATT W. EAGLE, Ann. Otol., Rhin. & Laryng. **55**:55 (March) 1946.

Secretory otitis media has definitely been increasing during the past few years, and the author suggests that since it is almost epidemic it may be the result of a virus infection. He reviews the symptoms and physical findings and reports on 172 cases, all except 1 of them being seen in the past four years. He advises the making of a small incision in the drum membrane and removal of the secretion by aspiration. The latter is done owing to the fact that the secretion is thick and viscid and "has the appearance of castor oil or bee's honey," and the viscosity is such that it may string out for several inches. Occasionally he has had to make a counteropening so as to allow air to be pulled through the middle ear. Usually the incisions close up in a matter of hours, and at least 75 per cent of his patients never had a recurrence of fluid in the middle ear. Of the remaining 25 per cent, only 3 patients required more than three additional myringotomies on the same ear. In only 1 of the 172 patients purulent otitis media developed. He found it rarely necessary to catheterize the eustachian tube and inflate the middle ear, as apparently the tube opened spontaneously after evacuation of the fluid. When catheterization was considered necessary, it was found that the patients were those with a prolonged involvement, requiring numerous myringotomies.

M. V. MILLER, Philadelphia.

MÉNIÈRE'S DISEASE IN A DEAF-MUTE. WALTER E. DANDY, Arch. Surg. **50**:74 (Feb.) 1945.

Dandy reports the case of a deaf-mute man aged 22 with typical Ménière's disease. When the right eighth nerve was sectioned, a congenital anomaly of the petrous portion of the temporal bone and the porus acusticus was noted, and the auditory nerve was observed to be abnormally small. There is no reason to believe that Ménière's disease is more common in deaf-mutes than in the general population, and therefore the combination of the two conditions in this case must be considered incidental. Congenital deaf-mutism is usually due to defect or malformation of the labyrinth, whereas the cause of Ménière's syndrome lies in a congenital or an acquired lesion of the auditory nerve.

LIST, Ann Arbor, Mich. [ARCH. NEUROL. & PSYCHIAT.]

THE TREATMENT OF ACUTE SUPPURATIVE OTITIS MEDIA WITH PENICILLIN. LOUIS WEINSTEIN and HILTON B. ATHERTON, J. A. M. A. **129**:503 (Oct. 13) 1945.

In 50 cases of acute suppurative otitis media (occurring as a complication of scarlet fever in 48) the treatment consisted of intramuscular injections of penicillin, 10,000 units every three hours until the external auditory canal had been dry for at least twenty-four hours. In 82 per cent of the cases the ear was dry in less than four and one-half days. Recurrence was noted in 16 per cent of the cases. In these the infection responded to larger doses of the drug. Two patients had peripheral facial paralyses, which gradually cleared. One patient had phlebitis of a lateral sinus. Two patients had elevated temperature attributed to penicillin allergy. No mastoid infections required surgical treatment.

Infections with Staphylococcus aureus alone or in combination with streptococci seemed to require larger doses. Infections with gram-negative bacteria responded to local treatment with a solution of 10 per cent ethyl carbamate and 1 per cent sulfanilamide.

The treatment recommended for acute otitis media is the intramuscular administration of penicillin, which is to be given in doses of 15,000 units every three hours from the time of the first appearance of exudate until the ear has been dry for seventy-two hours. BAIRD, Wauwatosa, Wis. [AM. J. DIS. CHILD.]

ON CLOSING TYMPANIC MEMBRANE PERFORATIONS. SAMUEL L. FOX, South. M. J. **38**:492 (July) 1945.

Fox describes a simple technic for closing a perforation of the tympanic membrane in selected cases that has proved highly successful. In cases selected for this treatment the middle ear must have been dry for several months and preferably for a year or longer; the perforation must be central in type and should not be more than 4 or 5 mm. in diameter. If an audiogram reveals a conduction loss of more than 40 decibels for tonal frequencies up to 2048 cycles per second, the chances for permanent closure are not good. The operator treats the perforation by carefully touching its margins with a small cotton-tipped wire applicator bearing trichloroacetic acid, being careful not to spill acid into the middle ear cavity. The patient returns the next day, and if there is no drainage in the middle ear a piece of Cargile's membrane one and a half times the size of the perforation is placed against the drum, covering the perforation. Closure usually occurs in one to four weeks, often with marked improvement of hearing.

SINGLETON, Dallas, Texas.

FACIAL PALSY IN CLOSED HEAD INJURIES: THE PROGNOSIS. J. W. TURNER, Lancet **1**:756 (June 10) 1944.

Turner discusses two types of post-traumatic facial palsy: that occurring at the time of injury and that of delayed onset. The second type developed two to eight days after the injury in the author's series of cases. There were 34 cases of this type (bilateral in 1 case), in 11 of which the paralysis was complete. In 19 cases the paralysis had cleared completely in three weeks; in 5 cases it took seven weeks to clear; in 1 case, twelve weeks, and in 5 cases, four months, though whether in all the last cases recovery took fully that much time is not known. In 1 other case there was partial recovery in six to eight months, and in 1 case, in which acute otitis media was a complication and the palsy developed five days after injury, no improvement appeared in six months. In 1 case the course was not followed. In the case of bilateral complete palsy recovery occurred in eight weeks.

Of the 36 cases of immediate palsy, the paralysis was complete in 19. In 9 of the 36 cases the palsy cleared in about three weeks, and in 15 cases recovery took six to eight weeks. In 3 cases recovery took three months, but in 6 others the patient did not start to regain normal movements until after this time, and then slow, incomplete recovery began. In 3 cases no improvement occurred in eighteen months to two years after injury; in 2 of these concomitant otitis media developed. The most troublesome feature of incomplete recovery was the presence of associated movements.

Turner believes that it is impossible to tell in the early stages whether a complete palsy will clear rapidly or not; but if after three weeks the faradic response is still obtainable, the outlook is good for complete recovery. Deafness on the same side is a common accompaniment of the palsy, but there is no relation between the degree of deafness and the time of recovery. Turner also thinks it is

probable that the petrous part of the temporal bone is always fractured in cases of traumatic palsy whether or not a fracture appears in the roentgenogram. The exact cause of the palsy is uncertain, but Turner suggests laceration or intraneural vascular accident as a cause of immediate paralysis and hemorrhagic compression of the nerve as the cause of delayed palsy.

The treatment recommended is a wire splint hooked around the mouth and behind the ear to support the muscle. Massage upward and backward can be done by the patient himself. Individual movements of facial muscles can be practiced in front of the mirror. "Regular treatment with the galvanic current is probably worth while, though experimental evidence of its value is still meager." The author feels that this series of cases provides no brief for surgical intervention for at least six months after injury; then exploration of the canal may be advisable.

McCarter, Boston. [Arch. Neurol. & Psychiat.]

Aseptic Meningitis by Way of Mastoiditis: Presentation of a Case. Fernando López Clares and Fernando Espinosa Ogarrio, Bol. méd. d. hosp. inf., México **2**:325 (Nov.-Dec.) 1945.

R. M. J., a 12 year old boy, became ill eight days before his hospitalization, complaining of left suppurative otitis. On his admission there were clinical signs arousing a suspicion of meningitis, which was later confirmed by the laboratory. There was a purulent oozing from the left ear, and the mastoid region of the same side was acutely inflamed.

The treatment was initiated with administration of sulfadiazine—0.50 Gm. every four hours. Treatment with penicillin was instituted the next day. On that same day mastoidectomy was done on the left side. The progress was slow but uneventful and the patient was discharged fifty-four days later.

The total doses administered were 1,940,000 units of penicillin and 105 Gm. of sulfadiazine.

Madero, México, D. F., Mexico. [Am. J. Dis. Child.]

Cortical Deafness. J. Lemoyne, Ann. d'oto-laryng. **10**:133 (Oct.-Dec.) 1944.

Lemoyne says that the auditory tract is only partially crossed and that a unilateral temporal lesion does not impair hearing. The auditory tract has two relays and comprises three neurons. The first neuron runs from Corti's ganglion to the bulbar nuclei; this is the cochlear nerve. The second or bulbodiencephalic neuron runs from the dorsal and ventral bulbar nuclei to the internal geniculate body. In this second segment the auditory tract is partly crossed. The crossed bundle comprises a superficial part (acoustic striae of the fourth ventricle) and a deep part, which at the level of the corpus trapezoideum constitutes the chief intercrossing of the auditory tract. The third neuron, the auditory radiations, runs from the internal geniculate body to the transverse temporal convolution, which comprises the center of the cortical projection of the auditory tract. This segment of the auditory tract assumes a special importance in the study of cortical deafness. The author presents the history of a patient with two associated types of disturbances: (1) severe bilateral hypacusia with dissociation of air and bone perception; (2) psychic deafness with total agnosia and disturbances of Wernicke's aphasia. He discusses the occurrence of cortical deafness and the differentiation of cortical deafness and bilateral labyrinthine deafness. The requirement of lesions involving the two transverse temporal convolutions explains the rarity of cortical deafness. A right temporal lesion has no effect; a left temporal lesion either has no effect or causes Wernicke's aphasia; in cases of bilateral temporal lesions either aphasia is evident or cortical deafness can pass unobserved and requires systematic investigations with the audiometer, or cortical deafness dominates but gives the impression of labyrinthine deafness.

J. A. M. A.

Pharynx

THE NASOPHARYNX: A STUDY OF 140 AUTOPSY SPECIMENS. A. R. HOLLENDER, Laryngoscope **56**:282 (June) 1946.

This study reveals that the pathologic significance of the nasopharynx is more important than is generally realized. The nasopharynx has been overlooked both by clinicians and by pathologists.

The gross and the histologic anatomy are discussed.

The pathologic conditions discovered in the 140 specimens include tuberculosis, hyperplasia of the nasopharyngeal tonsil and pharyngeal bursitis. One specimen revealed carcinoma, metastatic from carcinoma of the rectum. Other conditions found are discussed and tabulated. In all 48.5 per cent of the specimens showed pathologic change.

HITSCHLER, Philadelphia.

ACUTE PHARYNGITIS DUE TO A DECOMPENSATION OF THE CIRCULATORY SYSTEM. GEORGE R. LAUB, South. M. J. **37**:627 (Nov.) 1944.

The author reports 3 cases of "acute pharyngitis" due to early circulatory failure. The symptom in these cases is an acute sore throat. Examination shows no local evidence of infection in the nose or the throat. Occasionally there is an enlargement of the veins under the tongue and in the throat. Treatment of the circulatory disturbance usually clears up the soreness of the throat within two or three days.

SINGLETON, Dallas, Texas.

MIXED SALIVARY TUMORS OF THE PALATE. A. S. HANDOUSA BEY, Acta oto-laryng. orient. **1**:65, 1945.

The author reports 6 cases of mixed salivary tumors of the palate. These tumors are always unilateral as the midline is free of glands. They are slow growing, and in 1 case the growth was discovered during examination for another disease.

Early symptoms may include disturbed mastication, pain due to traumatic ulceration and pressure symptoms due to the size of the tumor. One patient complained of unilateral tinnitus and deafness, and examination showed the tumor to be encroaching on the orifice of the eustachian tube.

The tumors were removed surgically within their capsules with the exception of 1 which was malignant and was removed by diathermy. Recovery in all cases was uneventful.

MILTON L. JENNES, Waterbury, Conn.

Nose

NASAL SURGERY. W. RAYMOND MCKENZIE, South. M. J. **38**:42 (Jan.) 1945.

In nasal surgery the objectives are (1) the restoration of a normal and perfectly functioning air way, (2) the elimination of all pathologic tissue of the nose and its accessory sinuses and (3) the preservation or the correction of the contour of the nose. A careful and complete study of every case combined with intelligently planned treatment is absolutely essential if good results are to be obtained. Minor or incomplete surgical procedures are strongly condemned except in regard to certain cases in which the patient's life might be endangered by a complete operation. Reconstructive surgery should be applied early in life or as soon after the accident that produced the deformity as possible in order to prevent psychologic damage of the patient.

SINGLETON, Dallas, Texas.

CONTROL OF AIR-BORNE INFECTION, PARTICULARLY THE COMMON COLD. SVERRE QUISLING, Wisconsin M. J. **44**:1070 (Nov.) 1945.

A colloidal preparation of acetylsalicylic acid, specially ground so that the particles averaged 0.1 micron in size, was found to have increased germicidal

power as compared with ordinary preparations, in which the particles are 14 microns or more in size. The colloidal preparation was also found less irritating to mucous membranes, and it did not produce any perceptible change in blood clotting time or prothrombin. High chemical stability, low toxicity and convenience of administration are additional advantages of the drug.

The correlation between the caliber of the openings of the ducts in the skin and mucous membranes, the size of the virulent organisms and the size of the particles of the drug is pointed out. Penetration of the infected ducts may partially explain the action of the colloidal solution.

"Treatment in the early stages of a cold" was given to 200 patients. It consisted in inhaling two to three breathfuls of the colloidal powder two or three times daily for several days. Duration of the colds was decreased, and complications were much less frequent.

BAIRD, Wauwatosa, Wis. [AM. J. DIS. CHILD.]

Miscellaneous

A COMPARATIVE STUDY OF THE BACTERIOLOGIC FLORA OF NASAL AND NASOPHARYNGEAL MEMBRANES OF PATIENTS WITH CERTAIN OCULAR DISORDERS. C. BERENS and E. L. N. CUMMING, Am. J. Ophth. **28**:1313 (Dec.) 1945.

In a study of 277 sets of cultures of material from the nasal and nasopharyngeal membranes of 228 patients, Berens and Cumming found that in most instances cultures from both the nasal and the nasopharyngeal membrane are a far more reliable index of the presence of possible etiologic pathogens than are cultures from either site alone. Preliminary investigation suggests the necessity of securing cultures from more than these two sites in order to obtain a satisfactory bacteriologic picture of the upper respiratory tract.

W. S. REESE, Philadelphia. [ARCH. OPHTH.]

STATUS ASTHMATICUS. GEORGE O. CUMMINGS, Ann. Otol., Rhin. & Laryng. **55**:136 (March) 1946.

Status asthmaticus may be defined as a state of severe, unremitting asthma, which if not relieved results in death. Why this condition develops in so few asthmatic patients is unknown, unless it is because their fundamental allergy is reenforced by bacterial or virus infection. In many patients the pathologic processes are reversible. The most important pathologic change in status asthmaticus is the change of ciliated epithelium to mucus-producing goblet cells, which pour out into the bronchioles a thick, tenacious secretion, which is difficult to remove because the contents of some of the semievacuated cells are one with the mucous mass free in the bronchioles. During respiration this mucus produces a piston action, which eventually produces areas of atelectasis.

In general, many of these patients are dehydrated and lack nourishment. Infusions of 10 per cent dextrose may be of great value. The administration of digitalis may be necessary. The patient should be in a room free of dust, hangings and upholstered furniture. Allergen-proof casings should be on pillows and mattresses. Average room temperature with high humidity, rest and good nursing are important. Drugs such as epinephrine, ephedrine, or theophylline ethylenediamine are used to widen the airways. These may be given in various ways. Atropine, while it relieves bronchial spasms, dries secretion and is not useful. Iodides are given to aid in elimination of the mucus. An oxygen tent or oxygen mask eases breathing, and if helium, 80 per cent, and oxygen, 20 per cent, are given in a special helium tent or with a closed mask the force necessary for drawing this mixture into the lungs is only half of that required for air. Most opium derivatives depress respiration, dull the cough reflex and cause bronchiospasm and should not be used as sedatives. The barbiturates may be used, as may chloral hydrate and paraldehyde. Pentothal sodium has been used. Ether in oil and solution of tribromoethanol may be given by rectum in patients refractory to other drugs. A new synthetic

drug, demerol, has an antispasmodic effect on the bronchial musculature, a sedative action, and is effective in relieving pain. It somewhat dries the mucous membrane and does not affect the cough reflex. Its average dose is 100 mg. To combat infection, penicillin is useful. Bronchoscopy is useful for aspiration and ventilation. The author feels that the hyperventilation is the most valuable feature of the bronchoscopy.

Reports of cases are given. M. V. MILLER, Philadelphia.

LOCAL USE OF PENICILLIN IN INFECTIONS OF THE EAR, NOSE AND THROAT: RESULTS OF TREATMENT. FLETCHER D. WOODWARD and THOMAS HOLT, J. A. M. A. **129**:589 (Oct. 27) 1945.

Local treatment with penicillin was accomplished by use of (*a*) a solution of 500 units of sodium penicillin per cubic centimeter of isotonic solution of sodium chloride, (*b*) a water-soluble jelly containing 1,000 units per gram and (*c*) lozenges containing 800 units per lozenge. Application was by instilling drops into the ear, by spraying and instilling jelly into the nose, by lavage of the sinuses (if indicated) followed by the instillation of jelly, by slow dissolution of lozenges placed on the tongue for infections of the mouth and gums and by the latter combined with spraying of the throat for infections of the throat.

The local use of penicillin proved helpful in combating acute and subacute infections except acute otitis media. It was found helpful in some cases of chronic otitis media but of no value in chronic sinusitis. Combined treatment with systemically administered penicillin or with appropriate sulfonamide compounds enhanced the therapeutic effect. Local treatment did not produce any dramatic change in the bacterial flora of the nose and throat.

BAIRD, Wauwatosa, Wis. [AM. J. DIS. CHILD.]

ALLERGY IN THE PACIFIC. J. A. BLUE, J. Allergy **17**:97 (March) 1946.

The author points to an increase in the manifestation of allergy in the armed forces and states that many persons with dormant allergic potentialities break down under the stress of military regimentation, there being a large psychogenic factor involved. Tropical climates tend to precipitate allergic reactions. Allergy to penicillin was practically negligible, with only a few mild urticarial reactions. The slight toxic reactions of the sulfonamide drugs should always be borne in mind, while allergic reactions from blood plasma are rare but may occur in potentially allergic persons.

FRIEDBERG, Chicago.

CLINICAL RESULTS WITH BENADRYL. G. L. WALDBOTT, J. Allergy **17**:142 (May) 1946.

Some degree of dizziness and sleepiness is noted by the majority of patients taking Benadryl (beta dimethylaminoethyl benzhydryl ether hydrochloride). Three patients had to discontinue taking the drug, because of severe asthmatic attacks. The author feels that the side effects of Benadryl are less pronounced than those of ephedrine but more unpleasant than those of theophylline ethylenediamine. The drug is not a cure but is of strictly symptomatic value. Hives and hay fever respond better to Benadryl than does advanced asthma. Evidence would indicate that Benadryl is less effective on the bronchospasm of infectious asthma than on the allergic wheal.

FRIEDBERG, Chicago.

PENICILLIN THERAPY IN CHRONIC BRONCHIAL ASTHMA. H. C. LEOPOLD, J. Allergy **17**:166 (May) 1946.

There is no evidence that high dosage of penicillin administered intramuscularly for periods of seven to forty-five days had any permanent effect on the symptoms and signs of chronic perennial bronchial asthma of the infectious type. The signs

of asthma were not completely cleared in a single case. Eighty-nine per cent of the total series of 85 patients had no improvement. The volume of sputum was decreased in 33 per cent, although in no case was expectoration abolished. No change in the organism cultured from the sputum resulted from treatment in 81 per cent of the cases.

FRIEDBERG, Chicago.

SOME ANTIANAPHYLACTIC AND ANTIHISTAMINIC PROPERTIES OF PYRIBENZAMINE. C. E. ARBESMAN, G. F. KOEPF and G. E. MILLER, J. Allergy **17**:203 (July) 1946.

The authors have demonstrated the potent antianaphylactic activity of Pyribenzamine (N'pyridil-N'-benzyl-N-dimethylethylenediamine) on passively sensitized guinea pigs. In vitro studies of precipitin titer showed no effect of the drug on this factor. Guinea pig serum complement titers were not altered after intraperitoneal injection of Pyribenzamine. In human subjects oral administration of Pyribenzamine caused a reduction of the size of histamine wheals of the skin; the cutaneous reactivity of 14 of 24 allergic subjects was diminished after ingestion of the drug; a definite reduction of the reactivity of passively sensitized cutaneous sites also followed oral administration of Pyribenzamine.

FRIEDBERG, Chicago.

CLINICAL EXPERIENCES WITH A NEW ANTIHISTAMINIC DRUG. C. H. EYERMANN, J. Allergy **17**:210 (July) 1946.

In an analysis of results of treatment of a relatively small series of patients it was found that 67 per cent were completely relieved of the symptoms of pollen-produced allergic rhinitis by the administration of Benadryl (beta-dimethylaminoethyl benzhydryl ether hydrochloride). Twenty-three per cent experienced relief of sneezing but not of other associated symptoms. Nine per cent received no benefit. Prompt recurrence of the symptoms followed discontinuance of the treatment. Best results were noted in patients with chronic urticaria, but again cessation of the treatment was accompanied by recurrence of symptoms. Benadryl given in 50 mg. doses did not afford either as prompt or as effective relief of mild wheezing dyspnea as the oral administration of 0.03 Gm. of an ephedrine salt. Three of 4 patients with perennial vasomotor rhinitis were relieved while receiving the drug. Patients treated for primary nasal polyposis, vernal conjunctivitis, dysmenorrhea and migraine were not benefited.

FRIEDBERG, Chicago.

TRANSTHORACIC RESECTION OF THE ESOPHAGUS FOR CARCINOMA. EDWIN A. LAWRENCE, Rocky Mountain M. J. **43**:547 (July) 1946.

The first successful resection of the esophagus for carcinoma was performed over thirty years ago by Torek, but the operation did not become popular, because of certain inherent disadvantages. Later, Churchill and Sweet emphasized the feasibility of reestablishing the continuity of the stomach and esophagus within the pleural cavity. There are several advantages. The operation is less mutilating, multiple stage procedures are no longer necessary, the difficulties encountered with the construction and function of an anterior thoracic subcutaneous esophagus and various pieces of apparatus used to connect the esophageal and gastric stomas are obviated, and also the patient is able to ingest food in a normal fashion. It does not seem unreasonable to speculate that another advantage of the newer operation will be a greater rate of salvage. In the largest series of cases, reported by Sweet, of 71 cases of resection of carcinoma of the esophagus and stomach, 21 were cases of exclusively esophageal resections. Eleven of these resections were for tumors in the middle part of the esophagus and ten for carcinoma in the lower part of the esophagus.

Sweet has recommended routine drainage of the pleural cavity for a short postoperative period. This probably is wise. The anastomosis must be of the open type, and therefore there is necessarily a minimal contamination of the pleural cavity. Expansion of the lung, with complete obliteration of the pleural cavity, is not easily and quickly achieved, and a pleural effusion is almost certain to develop. All these points seem to favor the use of a thoracotomy drainage tube for twenty-four to forty-eight hours postoperatively. In postoperative cases the use of the Levine tube with suction is considered. It has been the custom to insert such a tube down to the point of the anastomosis at the time of operation. Actually the amount of fluid obtained by this suction has been relatively small, approximately a fifth of the estimated total amount of saliva production in a twenty-four hour period. It might be wiser to pass the tube directly through the anastomosis at the time of operation where it can lie in the stomach and prevent gastric dilatation. However, since it is impossible for the Levine tube to remove more than a fraction of the saliva passing by it, it does not seem unreasonable to suggest that a Levine tube not be used at all.

Of utmost importance in eliminating the complication of infection is early expansion of the lung to obliterate the free pleural space and thus prevent the continued accumulation of a pleural exudate. One preventive measure is to reexpand the lung every twenty to thirty minutes during the operation. Repeated thoracenteses can be resorted to, or a catheter can be left in the pleural space at operation and be removed after forty-eight to seventy-two hours, when the lung should be completely expanded. One of the most gratifying results of a successful resection with reunion of the stomach and the esophagus is the extreme degree of palliation obtained, even though a long term survival may be forthcoming.

A patient with carcinoma of the esophagus may be handled in one of four different ways. The surgeon may do nothing at all; he may recommend roentgen therapy; he may do a palliative gastrostomy for feeding purposes, or he may resect the tumor. The first course can never be condoned. Roentgen therapy is never satisfactory. A gastrostomy is only a gesture toward palliation; after this operation patients lead a miserable existence in the last few months of their lives. As contrasted to the aforementioned therapeutic measures, the palliative results obtained from a resection are immeasurably better.

A series of 4 cases of resection of carcinoma of the esophagus is reported. The importance of as well as methods for early obliteration of the free, pleural space in preventing postoperative empyema is emphasized. The decided improvement in palliation when compared with that obtained by other, less radical, therapeutic measures is demonstrated.

ROBERT LEWY, Chicago.

LOCAL CHEMOTHERAPY IN OTOLOGY, RHINOLOGY AND LARYNGOLOGY. P. R. BAARSMA, Nederl. tijdschr. v. geneesk. **88**:157 (Feb. 12-19) 1944.

Baarsma describes the results obtained in diseases of the nose, the ear and the sinuses and in infections of the lower airways, especially bronchiectasis and chronic bronchitis by local application of sulfanilamide derivatives. On the whole the results were favorable, especially in the cases of acute disease. For this local treatment those cases of bronchiectasis were reserved in which surgical treatment had to be excluded. First the secretion had to be sucked off. Then the patient coughed repeatedly. After that 50 to 100 cc. of a 5 per cent solution of sulfathiazole was introduced into the airways at the affected side by means of a half soft catheter. In cases of chronic bronchiectasis such a treatment was performed twice a week, or during one week the sulfathiazole solution was introduced twice a day by means of the aspiration method of Singer.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

Book Reviews

Les troubles de l'innervation pharyngo-laryngée et oesophagiennes. By Prof. F. J. Collet. Paper. Pp. 320, with 22 illustrations. Price 300 francs. Paris: Masson & Cie, 1946.

In the preparation of this monograph Professor Collet has quite successfully correlated the work of the laryngologist with that of the neurologist on subjects in which both these special groups are interested. He is particularly well qualified for such a task. Though a laryngologist of a half-century of experience as clinician and teacher, his work in neurology has been recognized by election to corresponding membership in the French Société de Neurologie.

First scanning the book and noting the great amount of wisely selected and valuable material it contains, one wishes for an index, but perusal reveals such a perfection of classification and arrrangement that the table of contents is found quite adequate for indexical purposes.

The text covers various paralyses, spasmodic disorders, and vasomotor, reflex and endocrine manifestations observed in the mouth, the palate, the tongue, the lips, the larynx, the pharynx, the esophagus, the neck and the shoulder. These subjects are grouped under five chapter heads. Each of these chapters is subdivided into articles, which are further subdivided into numbered sections. The style is not controversial. In a number of places the opinions of leading authorities, including Professor Collet himself, are stated impartially. All of the twenty-two illustrations are photoprocess reproductions of schematic pen and ink sketches. Notwithstanding the difficulties of publication in wartime, Masson and Company have as usual done their work well. The monograph should be read by every laryngologist and neurologist.

Clinical Methods of Neuro-Ophthalmologic Examination. By Alfred Kestenbaum, M.D., assistant clinical professor of ophthalmology, New York University; lecturer in ophthalmology, Mount Sinai Hospital; associate ophthalmologist, City Hospital. Price $6.75. Pp. 384. New York: Grune & Stratton, Inc., 1946.

Kestenbaum presents a book on clinical methods of neuro-ophthalmologic examination based on the result of twenty-five years of clinical work in close cooperation with the neurologic services of Drs. E. Redlich, J. Gerstmann, O. Marburg, O. Poetzl, J. Wilder, H. Hoff, N. Savitsky, F. Kennedy, E. D. Friedman, L. Hausman, B. S. Wortis, J. H. Nolan and B. Dattner.

He is modest and points out that the book is not meant to take the place of existing valuable texts, listing several of the latter, but that the volume should be found valuable as a supplement, as its emphasis is on clinical examination.

There are, in all, 384 pages, consisting of 13 chapters as follows: I. "Anatomy of the Optic Pathway," with three subtitles; II. "Field of Vision," with eight subtitles; III. "Pathology of the Optic Nerve," with seven subtitles; IV. "Chiasmal Lesions," with six subtitles; V. "Retrochiasmal Lesions of the Optic Pathway (Homonymous Hemianopsia)," with two subtitles; VI. "Eye Muscle Palsy," with four subtitles; VII. "Gaze Movement and Gaze Palsy," with seven subtitles; VIII. "Nystagmus," with four subtitles; IX. "Disturbance of the Symmetrical Eye Movements," with six subtitles; X. "Pupil Accommodation," with seven subtitles; XI. "Palpebral Fissure Miscellaneous," with seven subtitles; XII. "Functional Disturbances. Hemicrania," with ten subtitles; XIII. "Routine Neuro-Ophthalmological Examination." In addition there are a glossary of 12 pages, a bibliography and an author index of 15 pages and an index.

The entire theme has been coherently presented. There are cross references in the text matter that permit the reader to obtain a fuller discussion of some of the closely related diagnostic signs that one meets clinically.

It is obvious, as the author states, that more precise methods have been introduced in neuro-ophthalmologic examinations. These examinations will be of value, in some instances, as contributions to neurologic diagnosis, much the same as neuro-otology.

The author has further increased the value of his book by avoiding redundancy and repetitiousness. He has a thorough grasp of the entire subject and states it directly, clearly and effectively. It is a highly important subject, covering the eye and the nerve pathways to and from the brain, with detailed ocular findings and the significance thereof.

This book should be of great value to all ophthalmologists, neurologists, neuro-otologists and otolaryngologists doing ophthalmologic work, as well as graduate students and residents in these specialties. It is a practical contribution.

The Human Ear in Anatomical Transparencies: Descriptive Text. By Dr. Stephen L. Polyak. Anatomical Transparencies by Gladys McHugh. Anatomic Preparations. By Delbert K. Judd. Published under the auspices of the Sonotone Corporation. Price $10.50. Pp. 136. New York: T. H. McKenna, Inc., 1946.

This magnificent atlas of dissections of the ear and its adjacent structures parallels a similar work on the eye by Professor Polyak, head of the department of anatomy of the University of Chicago, The School of Medicine. The previous work was sponsored by a firm of optical manufacturers, while this has received generous financial support from the Sonotone Corporation.

To persons beginning or long interested in the specialty of otology, the dissections by Professor Judd are a revelation and a reminder that recollections of personal, hurried and sketchy work on cadavers are insufficient for accurate understanding of the complex relations of the vestibular and cochlear mechanisms with the middle ear. By the brilliant technic of Miss McHugh, overlying transparencies reconstruct these complex structures in the colors of life, not those of embalmed anatomic specimens.

Professor Polyak includes developmental summaries of hearing, speech and equilibration in his well considered though necessarily brief review of this field of regional anatomy. This atlas is a most valuable aid to the student of otology, and it should serve as an excellent adjunct in the training of residents, particularly where the facilities of anatomic laboratories are limited.

Allergy. By Erich Urbach, M.D., and Philip M. Gottlieb, M.D. Second edition. Pp. 968, with 410 illustrations. Price $12. New York: Grune & Stratton, Inc., 1946.

The volume is encyclopedic in nature and must be praised for its exhaustive handling of the various problems of allergy in the human body. A tremendous amount of work must have been done to complete the many valuable references and footnotes. It is indeed rare to find such a complete and recent bibliography.

Although there are many controversial questions concerning allergy, or hypersensitiveness of persons, there is little in the book that is dogmatic or prejudiced. The general practitioner and specialist have a ready source of inclusive data in this large double format volume.

One cannot but be impressed with the authors' knowledge of medicine in general and its application to allergy in particular. The sections on involvement of the upper respiratory tract in allergic persons are handled admirably.

The operating otolaryngologist has learned only too well how futile many of his operations on the septums and sinuses have been. Hansel is quoted as saying that in 1,000 cases of operation at least 400 patients were definitely subject to allergy and should have been treated medically instead of surgically.

To be a good allergist requires the ingenuity of Sherlock Holmes and the patience of Job. However, if one keeps in mind the simple picture of hypersensitivity in the nose and the skin, it does not take a master mind to diagnose properly and treat the perennially "running nose" or the epidermis full of hives.

The latest technics, in their utter simplicity, are presented in a forthright manner, with just enough skepticism of the absolute results of the various tests to satisfy the most carping critic. Indeed, it is this fulness to which some hasty men might object; in short, this is no hit and run volume of bare essentials. The meager fare of a handbook often leaves too much to be desired and rarely solves the difficult case for the anxious physician. In outlying districts where consultants are few and far between, such a volume, with its many exact and beautiful illustrations, is a concrete addition to any one's armamentarium. Even the numerous reports of cases of single unusual successes prove a boon to the reader and stimulate the imagination to be on a sharper lookout for hypersensitivity of the nose, the gastrointestinal tract and the skin.

Most of us are too prone to skip over anaphylactic shock as happening to other patients and not ours. Increased sensitivity to horse serum and foreign proteins should make us beware of speedy and universal treatments. The newer antibiotics given intramuscularly are not too bad, but in salves and lotions they build up unpleasant after-effects.

The additions, improvements and deletions of this monumental second edition make it a worth while member of a complete medical library—a library wherein are recorded the failures as well as the successes in this particularly difficult branch of medicine. Only too often one finds oneself dealing with the psychosomatic rather than the organic, at whic htime the only recourse is a man especially skilled in psychiatry as it relates to medicine in general.

The authors do not claim a cure-all for allergy, but they do write a convincing narrative for its more universal application and the extreme necessity for its awareness on the part of all men who profess to treat people for their manifold illnesses.

Directory of Otolaryngologic Societies *

INTERNATIONAL

First Pan-American Congress of Oto-Rhino-Laryngology and Bronchoesophagology

President: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
Secretary: Dr. Chevalier L. Jackson, 255 S. 17th St., Philadelphia 3.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. J. Mackenzie Brown, 1136 W. 6th St., Los Angeles.
Secretary: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.
Place: Atlantic City. Time: June 9-13, 1947.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Alan C. Woods, Johns Hopkins Hospital, Baltimore 5.
President-Elect: Dr. C. H. McCaskey, 20 N. Meridian St., Indianapolis, Ind.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100–1st Ave. Bldg., Rochester, Minn.
Place: Palmer House, Chicago. Time: Oct. 12-17, 1947.

American Broncho-Esophagological Association

President: Dr. Robert M. Lukens, Medical Arts Bldg., Philadelphia 2.
Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago 11.
Place: Hotel Brighton, Atlantic City. Time: June 9, 1947.

American Laryngological Association

President: Dr. Frank R. Spencer, Physicians Bldg., Boulder, Colo.
Secretary: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis.
Place: Hotel Statler, St. Louis. Time: April 23-24, 1947.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Harry W. Lyman, 906 Carleton Bldg., St. Louis.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: Hotel Statler, St. Louis. Time: April 25-26, 1947.

SECTIONS:

Eastern.—Chairman: Dr. Robert F. Ridpath, 18th and Chestnut Sts., Philadelphia.
Southern.—Chairman: Dr. Walter T. Hotchkiss, 541 Lincoln Rd., Miami Beach, Fla.
Middle.—Chairman: Dr. Oliver E. Van Alyea, 135 S. La Salle St., Chicago.
Western.—Chairman: Dr. Colby Hall, 1136 W. 6th St., Los Angeles, Calif.

American Otological Society

President: Dr. William E. Grove, 324 E. Wisconsin Ave., Milwaukee, Wis.
Secretary: Dr. Gordon D. Hoople, 713 E. Genesee St., Syracuse, N. Y.
Place: Hotel Statler, St. Louis. Time: April 21-22, 1947.

American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Alfred Schattner, 115 E. 61st St., New York.
Secretary: Dr. Norman N. Smith, 291 Whitney Ave., New Haven, Conn.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.